ACTURA OPTIMA 48200 (PS48165/3200) Power Supply System

User Manual

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Emerson Network Power provides customers with technical support. Users may contact the nearest Emerson local sales office or service center.

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Safety Precautions

To reduce the chance of accident, please read the safety precautions very carefully before operation. The "Caution, Notice, Warning, Danger" in this book do not represent all the safety points to be observed, and are only supplement to various safety points. Therefore, the installation and operation personnel must be strictly trained and master the correct operations and all the safety points before actual operation.

When operating Emerson products, the safety rules in the industry, the general safety points and special safety instructions specified in this book must be strictly observed.

Electrical Safety

I. Hazardous voltage

Danger

Some components of the power system carry hazardous voltage in operation. Direct contact or indirect contact through moist objects with these components will result in fatal injury.

Safety rules in the industry must be observed when installing the power system. The installation personnel must be licensed to operate high voltage and AC power.

In operation, the installation personnel are not allowed to wear conductive objects such as watches, bracelets, bangles, rings, etc.

When water or moisture is found on the cabinet, turn off the power immediately. In moist environment, precautions must be taken to keep moisture out of the power system.

"Prohibit" warning label must be attached to the switches and buttons that are not permitted to operate during installation.

Danger

High voltage operation may cause fire and electric shock. The connection and wiring of AC cables must be in compliance with the local rules and regulations. Only those who are licensed to operate high voltage and AC power can perform high voltage operations.

II. Tools

Warning

In high voltage and AC operation, special tools must be used. No common or self-carried tools should be used.

III. Thunderstorm

Danger

Never operate on high voltage, AC, iron tower or mast in the thunderstorm.

In thunderstorms, a strong electromagnetic field will be generated in the air. Therefore the equipment should be well earthed in time to avoid damage by lightning strikes.

IV. ESD

Notice

The static electricity generated by the human body will damage the static sensitive elements on PCBs, such as large-scale ICs, etc. Before touching any plug-in board, PCB or IC chip, ESD wrist strap must be worn to prevent body static from damaging the sensitive components. The other end of the ESD wrist strap must be well earthed.

V. Short circuit

Danger

During operation, never short the positive and negative poles of the DC distribution unit of the system or the non-grounding pole and the earth. The power system is a constant voltage DC power equipment, short circuit will result in equipment burning and endanger human safety.

Check carefully the polarity of the cable and connection terminal when performing DC live operations.

As the operation space in the DC distribution unit is very tight, please carefully select the operation space.

Never wear a watch, bracelet, bangle, ring, or other conductive objects during operation.

Insulated tools must be used.

In live operation, keep the arm muscle tense, so that when tool connection is loosened, the free movement of the human body and tool is reduced to a minimum.

Battery

Danger

Before any operation on battery, read carefully the safety precautions for battery transportation and the correct battery connection method.

Non-standard operation on the battery will cause danger. In operation, precautions should be taken to prevent battery short circuit and overflow of electrolyte. The overflow of electrolyte will erode the metal objects and PCBs, thus causing equipment damage and short circuit of PCBs.

Before any operation on battery, pay attention to the following points:

Remove the watch, bracelet, bangle, ring, and other metal objects on the wrist.

Use special insulated tools.

Use eye protection device, and take preventive measures.

Wear rubber gloves and apron to guard against electrolyte overflow.

In battery transportation, the electrode of the battery should always be kept facing upward. Never put the battery upside down or slanted.

Others

I. Sharp object

Warning

When moving equipment by hand, protective gloves should be worn to avoid injury by sharp object.

II. Cable connection

Notice

Please verify the compliance of the cable and cable label with the actual installation prior to cable connection.

III. Binding the signal lines

Notice

The signal lines should be bound separately from heavy current and high voltage lines, with binding interval of at least 150mm.

Contents

Chapter 1 Overview

ACTURA OPTIMA 48200 (PS48165/3200) power supply system supplies -48V DC powers to telecommunication equipment. It can be widely used in base transmission stations (BTSs), medium- small capacity exchange stations, and satellite communication.

1.1 System Configuration

PS486200 is composed of distribution unit, rectifier subrack and cabinet.

The configuration table of the power system is shown in Table 1-1. The internal structures are shown in the figure 1-1.

Table 1-1 ACTURA OPTIMA 48200 (PS48165/3200) system configuration

	Components	Number
Distribution unit	AC input terminals	2~4
	DC SPD (optional)	1
	Load MCB	1~20
	Rectifier MCB (optional)	2~3
Rectifier subrack	M500D monitoring module	1
	R48-3200 rectifier	1~3
	Battery MCB	1~4
	Load MCB	2
Battery rack (optional)		1

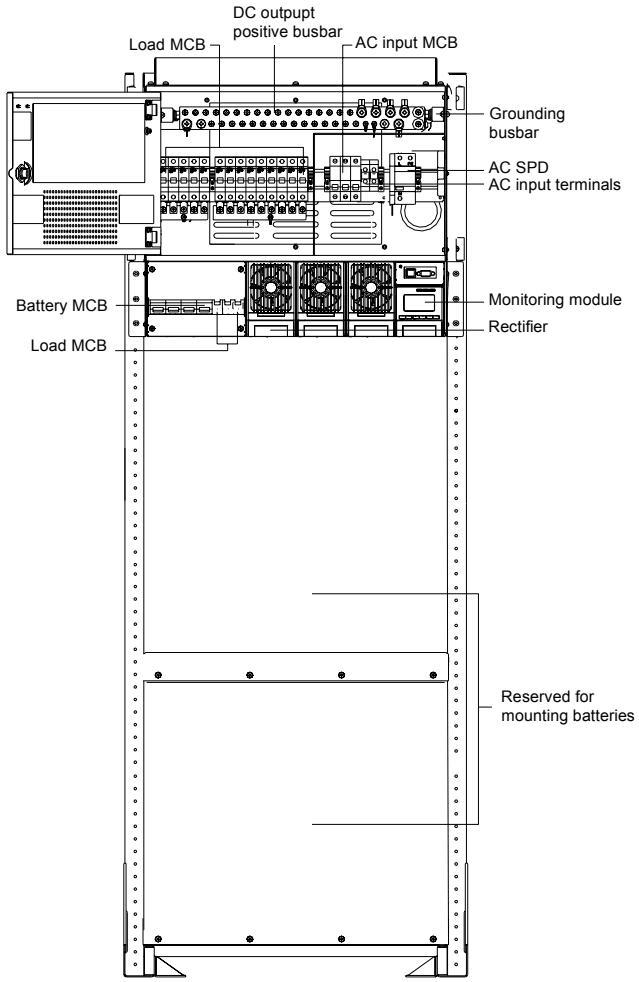


Figure 1-1 ACTURA OPTIMA 48200 (PS48165/3200) system structure

1.2 Features

- The rectifier uses the active Power Factor Compensation (PFC) technology, raising the power factor to 0.99.
- Wide AC input voltage range. 85V ~ 290V for manual switching system.
- The rectifier uses soft switching technology, raising the efficiency to 91%
- Ultra-low radiation. With advanced EMC design, the rectifier meets international standards such as CE and NEBS. Both the conducted and radiated interference reach Class B
- The rectifier safety design complies with UL, CE and NEBS standards
- High power density
- Rectifiers are hot pluggable. It takes less than 1min to replace a rectifier
- Two over-voltage protection methods are optional: hardware protection and software protection. The latter one also has two optional modes: lock-out at the first over-voltage and lock-out at the second over-voltage.
- Perfect battery management: The management functions include the LLVD, BLVD, temperature compensation, auto voltage regulation, stepless current limiting, battery capacity calculation and on-line battery test, etc.
- Up to 200 pieces of historical alarm records, and 10 sets of battery test data records.
- Network design: Providing multiple communication ports (such as RS232, modem and dry contacts), which enables flexible networking and remote monitoring
- Complete fault protection and fault alarm functions

1.3 Components

The power distribution unit is on the upper side of the cabinet. The rectifier model is R48-3200, and the model of monitoring module is M500D. Eight blocks of batteries can be mounted in the battery rack. The appearances of the components are shown in the following figures.

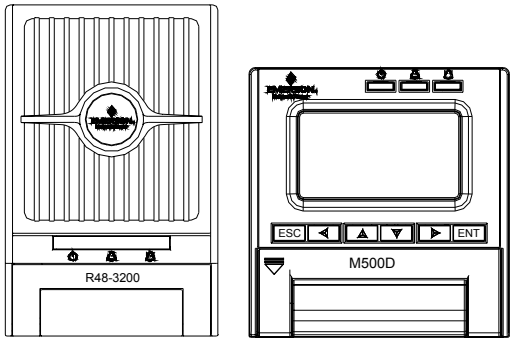


Figure 1-2 Module appearances

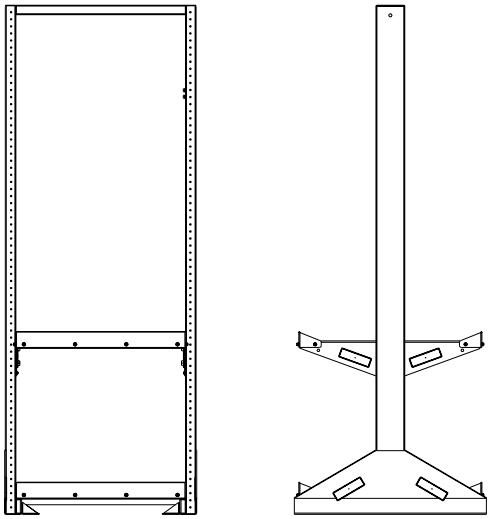


Figure 1-3 Battery rack appearance

Chapter 2 Installation Instruction

2.1 General

All the bolts and nuts in this power system are compliant with ISO standards.

Please follow this instruction to carry out the installation step by step.

2.1.1 Safety Regulations

Certain components in this power system have hazardous voltage and current. Always follow the instructions below:

1. Only the adequately trained personnel with satisfactory knowledge of the power system can carry out the installation. The most recent revision of these safety rules and local safety rules in force shall be adhered to during the installation.

2. All external circuits that are below 48V and connected to the power system must comply with the requirements of SELV as defined in IEC 60950.

3. Make sure that the power (mains and battery) to the system is cut off before any operations can be carried out within the system cabinet.

4. The power cabinets shall be kept locked and placed in a locked room. The key keeper should be the one responsible for the power system.

5. The wiring of the power distribution cables should be arranged carefully so that the cables are kept away from the maintenance personnel.

2.1.2 Documents

The following are the documents necessary for the installation:

- This book
- Power system related documents, such as floor plan, (room) allocation drawing and shipping specifications
- Battery related documents from the battery supplier

2.1.3 Tools & Material Preparation

Tools needed for system installation

Electric drill, wire cutter, pliers, various wrenches, screwdriver, electrician knife, tin and steel saw.

The tools must be insulated and have antistatic handles.

Power cables for electrical connection

AC cables, DC load cables, battery cables and earth cables.

The cable design should meet relevant industry standards, and be purchased according to the design material list.

Note

Different countries have different regulations on the cable color. Select cables according to your local regulations. In this book, the cables are selected in compliance with IEC standard.

1. AC input cables

It is recommended to use the RVVZ cables, such as the Polyvinyl Chloride Insulated Copper-cored Fire-resistant Wire. The cable should reach at least +70°C temperature durability. The AC phase line A, phase line B, phase line C, neutral line and earth line should be distinguished with 5 colors: yellow, green, red, light blue and yellow-green. If the cables are of the same color, they should be identified with labels.

Factors such as temperature/voltage change and mechanical strength should be taken into consideration when choosing the mains cable Cross-Sectional Area (CSA) according to the related industry regulations. With cable length

shorter than 30 meters, the CSA calculation should be based on the current density of 2.5A/mm^2. The suggested CSA value is no less than 25mm^2.

2. Battery cables and DC power distribution cables

The size depends on the current flowing through the cable and the allowable voltage drop.

To select the battery cable CSA, see the following table (with ambient temperature of 25°C).

Table 2-1 Battery cable CSA selection

Battery MCB rated current	Max. battery current	Min. cable CSA	Max. cable length (allowable voltage drop: 0.5V)
400A	300A	150mm^2	14m
500A	400A	95mm^2 (2 pcs) or a 185mm^2	14m

Note

1. The battery cable should reach at least +90°C heat durability.

2. It is recommended to use double-insulated copper-core flame retardant cable as battery cable.

Select the DC load cable CSA according to the following table:

Table 2-2 DC load cable selection

Load route rated current	Max. output current	Min. cable CSA	Max. cable length (volt drop: 0.5V, with min. CSA)	Max. cable CSA	Max. cable length (volt drop: 0.5V, with max. CSA)
250A	160A	50 mm^2	9m	95 mm^2	17m
100A	50A	25 mm^2	14m	50 mm^2	25m
63 A	32 A	16 mm^2	7 m	25 mm^2	11 m
32 A	16 A	16 mm^2	14 m	25 mm^2	22 m
10 A	5 A	6 mm^2	17 m	25 mm^2	71 m

The MCB capacity should be strictly limited so that it can function properly upon load over-current. The recommended MCB capacity is 1.5-2 times the load peak capacity.

Note

Generally the maximum output current is calculated based on the maximum loads.

When the allowable voltage drop is not 0.5V, the CSA of the DC load cables and battery cables should be calculated by the following formula:

$A=\Sigma I \ 3 \ L/(K\triangle U)$

Where: A is the CSA of the cable (mm^2), ΣI: the total current (A) flowing through the cable; L: the length (m) of the cable loop; △U: the allowable voltage drop in the cable; K: the conductivity factor. Kcopper=57.

It is suggested to use colored wires to distinguish the cable polarities: Black for positive pole and blue for negative.

If the available cables are of one color, use numbered or colored labels to distinguish them.

Earth cables

The CSA of the system earth cable should be consistent with that of the maximum power distribution cable and no less than 16mm^2.

Purchasing materials according to the construction materials list and inspect the materials

Check the heat durability, moisture resistance, flame resistance and voltage resistance of the cable.

Auxiliary materials for power equipment installation

Including expansive bolts, binding strips, insulating tape, etc.

2.1.4 Unpacking Inspection

To ensure smooth installation, the power equipment must be carefully inspected when it is unpacked.

The equipment should be unpacked and inspected after it arrives at the installation site. The inspection shall be done by representatives of both the user and Emerson Network Power Co., Ltd.

To inspect the equipment, you should:

1. Open the packing case in which the packing list is put.

2. Take out the packing list.

3. Check against the packing label, including customer name, customer address, machine No., total amount, case No., contract No., etc.

Unpacking and inspection: After opening the packing case, check the goods one by one according to the goods list on the packing label. The checking should include:

1. The number of the packing cases and the serial number marked on them.

2. The correctness of the equipment packing according to the packing list.

3. The number and model of the accessories according to the accessory list.

4. The completeness of the equipment set according to the system configuration.

5. The condition of the goods through visual inspection. For example, check the cabinet for any damage and condensation. Shake the rectifier module gently to see if any component or connection has loosened during transportation.

Fitting parts

The following parts are for fitting the cabinet:

- Rectifiers
- Monitoring module

For the sake of safety, the modules should not be unpacked until the installation.

Floor fixing parts

Select the proper floor fixing parts (there is a set of floor fixing parts as an accessory to the cabinet upon delivery).

2.1.5 Installation Procedure

1. Fixing the power cabinet
2. Mounting rectifiers and monitoring modules
3. Connecting AC/DC cables
4. Connecting the temperature/humidity sensor
5. Mounting the modem
6. Connecting the monitoring module dry contacts

2.2 Fixing The Cabinet/ Battery Rack

The installation procedures of the cabinet and the battery rack are the same. Follow the steps below to install them:

1. Mark the specific installation position of the cabinet/ battery rack

The power cabinet/ battery rack must be installed directly onto the cement floor. Determine the installation position of the power cabinet/ battery rack in the equipment room according to the installation chart.

By referring to the mechanical parameters (see Figure 2-1 and Figure 2-2) of the installation holes, determine the exact central points of the installation holes on the floor, and mark them with a pencil or oil pen.

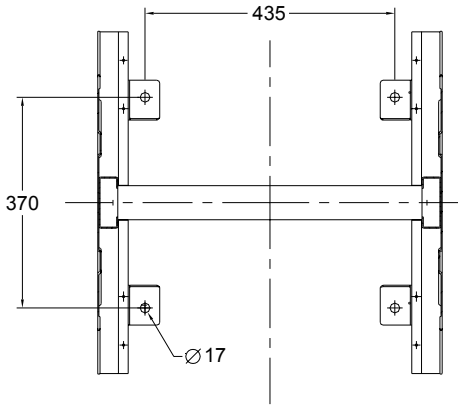


Figure 2-1 Installation size of the cabinet base (unit: mm)

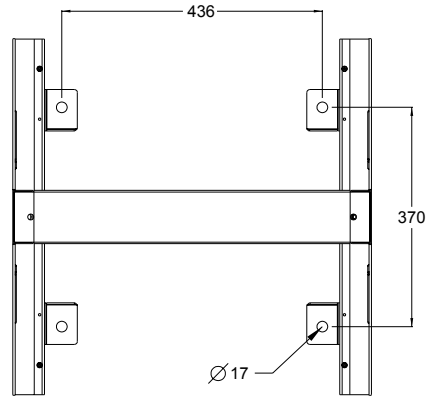


Figure 2-2 Installation size of the battery rack base (unit: mm)

Maintenance access should be preserved between cabinets, and be no less than 1.5m wide.

See Figure 2-3.

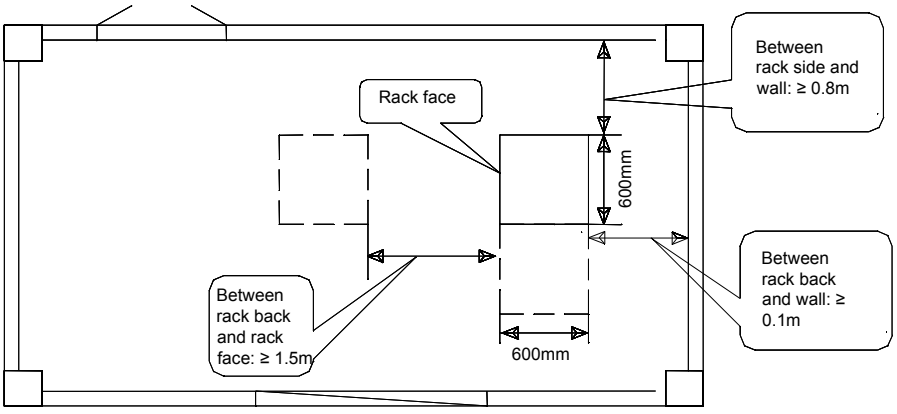


Figure 2-3 Equipment room layout

2. Drill holes

The expansion bolt, as a product accessory, is of M10×55mm. Use the electric drill (aiguille: &14) to dig holes (depth: 70mm) at the marked points. See Figure 2-4.

3. Install the expansion bolt.

Clean the drilled hole of dust. Put the expansion bolt into the hole and knock it with a hammer till it is totally in. See Figure 2-4.

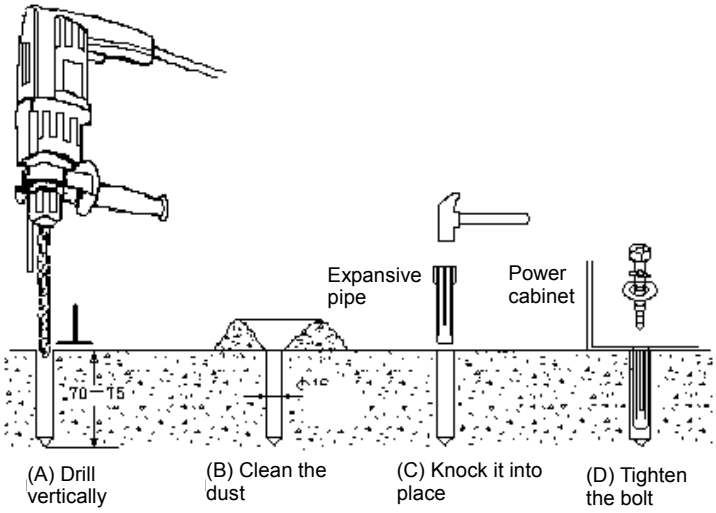


Figure 2-4 Installing expansion bolt on the floor

4. Place the cabinet/ battery rack

Move the cabinet/ battery rack to the installation position. Make the installation holes on the cabinet coincide with those dug on the floor.

5. Fix the cabinet/ battery rack

Make fine adjustment to the cabinet/ battery rack position by, for example, inserting some metal plates under the cabinet, to make the vertical obliquity of the cabinet less than 5 degrees. Screw the expansion bolt together with plain washer and spring washer down into the expansion pipe in the floor. The cabinet/ battery rack is then fixed to the ground. See Figure 2-5.

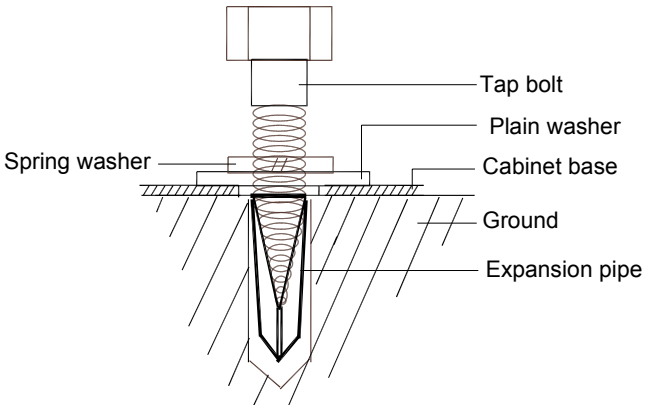


Figure 2-5 Fixing the cabinet with expansion bolt

After installation, the cabinet/ battery rack should stand firmly no matter how it is shaken.

2.3 Installing Rectifiers And Monitoring Module

Installing rectifiers

Push the handle into the module panel, and the positioning pin will pop out from the module bottom; click the handle to pop it out, and the positioning pin will retract into the module. The use of handle is shown in Figure 2-6:

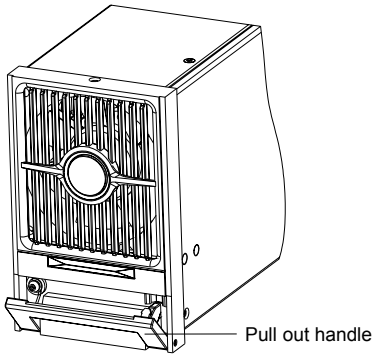


Figure 2-6 Pull out handle

Put the rectifier onto the guide rail (see figure 2-7 for installation positions). Push the rectifier completely into the cabinet. Push the handle into the front panel to pop out the positioning pin and lock the rectifier to the cabinet. The mounted rectifiers are shown in the following figure.

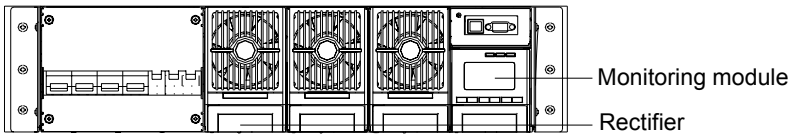


Figure 2-7 Mounted modules

In the non-full-configuration, insert the rectifiers into the slots from left to right.

To pull out the rectifier, you should release the handle to retract the positioning pin and pull the rectifier out directly.

Notice

To push the rectifier into the installation slot, you should hold the rectifier handle and be gentle, or the positioning pin might be damaged.

When the rectifier is working, the radiator could be very hot. Do not touch the radiator directly to avoid scald.

Installing monitoring module

Repeat the above installation procedures to install the monitoring module to the position shown in Figure 2-7.

2.4 Connecting Cables

Danger

1. Switch off all MCBs before the electrical connection.
2. Only the qualified personnel can do the mains cable connection.

Connecting power cables

Connect the power cable to the AC terminals, as shown in Figure 2-8. The cables can be led in through the top of the cabinet.

Connecting load cables

Connect the negative pole to the load MCB terminal with a cable and connect the positive pole to the DC output positive busbar, as shown in Figure 2-8.

When connecting cables of the MCBs at the back of the panel of MFU200, you need to remove the fixing screws and take off the panel first and then connect the cables.

Connecting battery cables

Note

1. The batteries may have dangerous current. Before connecting the battery cables, the corresponding battery input MCBs or the battery cell connector must be disconnected to avoid live state of the power system after installation.

2. Be careful not to reverse connect the battery. Otherwise, both the battery and the power system will be damaged!

The battery cables are connected before delivery. The user should connect the battery cables to the batteries according to the battery user manual.

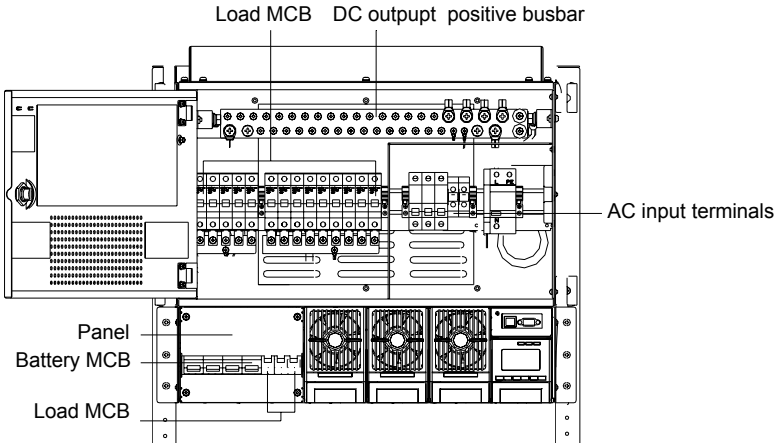


Figure 2-8 Cable connection positions

2.5 Connecting Signal Cables

The signal cables need to be connected to the signal transfer board. There are two signal transfer board in the system: B242HFX1 and S6415X2. The position of B242HFX1 signal transfer board is shown in Figure 2-9.

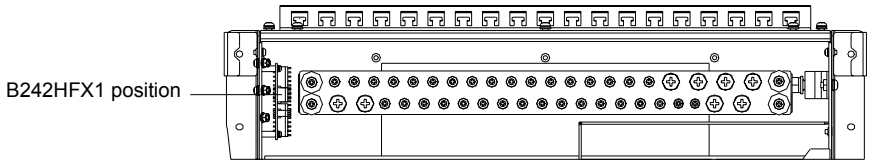


Figure 2-9 B242HFX1 position

The interfaces of B242HFX1 are shown in Figure 2-10.

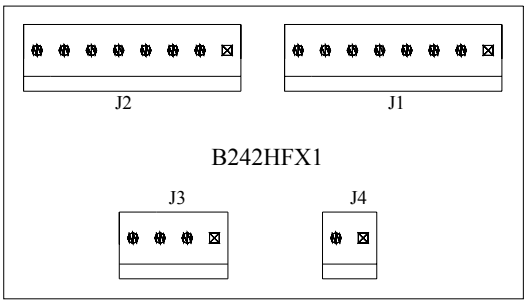


Figure 2-10 B242HFX1 interface

The signal transfer board B242HFX1 is a logical signal transfer board. It defines every 10 outputs as 1 alarm branch, and the branch will raise alarms when any output(s) in the branch is/are faulty. If one of the 9~18 load MCBs is disconnected, the system will generate an alarm of ‘Load 9 failure’. If one of the 19~28 load MCBs is disconnected, the system will generate an alarm of ‘Aux Load Fails’. The interfaces of the board are described in Table 2-1.

Table 2-3 B242HFX1 interface description

Interface	Pin No.	Application	Pin No.	Application
J1 (P101-8)	1	Open/closed status input of MCB 9	2	Open/closed status input of MCB 10
	3	Open/closed status input of MCB 11	4	Open/closed status input of MCB 12
	5	Open/closed status input of MCB 13	6	Open/closed status input of MCB 14
	7	Open/closed status input of MCB 15	8	Open/closed status input of MCB 16
J2 (P101-8)	1	Open/closed status input of MCB 17	2	Open/closed status input of MCB 18
	3	Open/closed status input of MCB 19	4	Open/closed status input of MCB 20
	5	Open/closed status input of MCB 21	6	Open/closed status input of MCB 22
	7	Open/closed status input of MCB 23	8	Open/closed status input of MCB 24
J3 (P101-4)	1	Open/closed status input of MCB 25	2	Open/closed status input of MCB 26
	3	Open/closed status input of MCB 27	4	Open/closed status input of MCB 28
J4 (P101-2)	1	Open/closed status output of MCBs 9~18	2	Open/closed status output of MCBs 19~28

The position of S6415X2 signal transfer board is shown in Figure 2-11. There are two communication interfaces in the panel: Ethernet and RS- 232 interface. The power supply system can be connected to Ethernet through the Ethernet interface or connected to modem through RS- 232 interface.

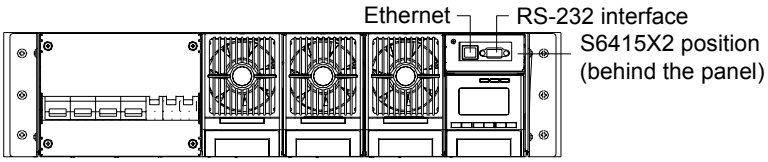


Figure 2-11 S6415X2 position

Connecting communication cables

Modem is an optional accessory, suitable for those who have purchased the modem remote monitoring system.

The following figure is an introduction to the specific modem installation position and connection, taking e-TEK TD-5648DC modem for example.

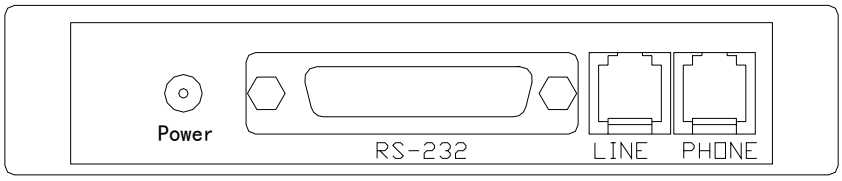


Figure 2-12 Input & output interfaces of TD-5648DC modem

The cable connection of the Modem is described below:

1. Connect the phone line to the ‘LINE’ interface of the Modem.

2. Connect one end of the communication cable to the ‘RS- 232’ DB25 (female) interface, and the other end to J13 interface (DB25, male) of the S6415X2 board, as shown in Figure 2-11 or in Figure 2-13.

Modem configuration:

In modem mode, "Y" should be selected for the communication parameter "MODEM" of the monitoring module. If modem has the Automatic Answer indicator (AA), the indicator will turn on once modem and monitoring module are powered on. In the modem mode, the monitoring module will initialize modem upon power-on, reset or upon communication interruptions that last more than one hour.

Connecting temperature sensor cable

The temperature sensor (cable) is an optional accessory.

Operating voltage: 5V

Measurement range: -5°C ~ 100°C

Measurement precision: 6 2°C

Note

The temperature probe cannot be placed inside the cabinet if the battery is installed outside the cabinet.

Connecting Procedures:

1. Connect the three-pin plug of the temperature sensor cable to the J10 or J11 socket of the S6415X2 signal transfer board, as shown in Figure 2-13.

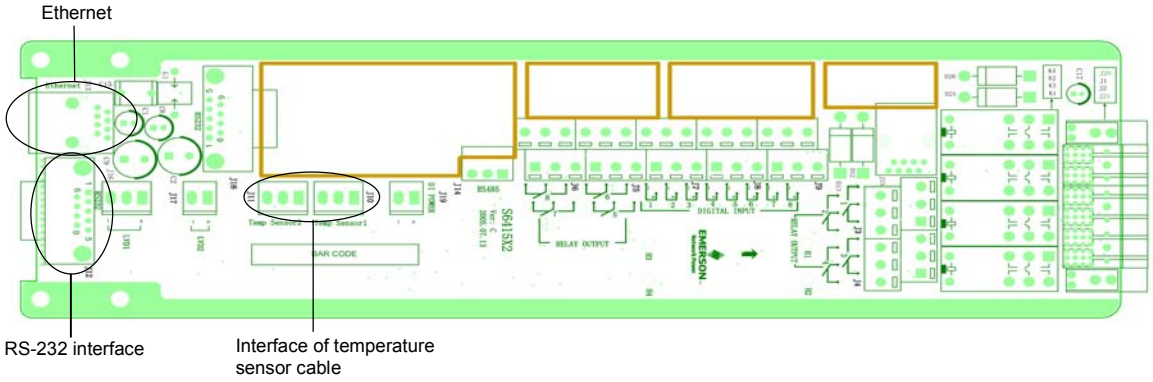


Figure 2-13 S6415X2 interfaces

2. Place the temperature probe at the location where the temperature can be best measured. The location should be away from heating devices. If the batteries are placed outside the cabinet, the temperature probe should not be placed inside the cabinet.

Chapter 3 Installation Testing

3.1 General

The power system must be tested in either of the following cases:

- As the acceptance test of a new power system
- As the acceptance test after the system capacity expansion

The corresponding safety rules shall be adhered to in the test.

Read through this book before starting the test.

3.1.1 Preliminaries

Before the test, inform the chief manufacturer representative. There may be alarms and corresponding control operations during the process.

Test equipment: multimeter.

During operation, parts of this equipment carry hazardous voltage. Misoperation can result in severe or fatal injuries and property damage.

- Only trained electrical engineer can maintain and operate this equipment.
- Before the test, check the equipment to ensure the proper earthing.
- Only spare parts approved by the manufacturer can be used.

3.2 Installation Check

3.2.1 Cabinet

	OK	Comments
Inspect the cabinet and accessories for compliance with the offer and delivery note.	☐	
Check the fixing of the cabinet on the floor.	☐	
Check the bus bar connections if possible.	☐	
Check the connection between the power system and the system grounding.		
Does the grounding of the cabinet (s) conform to the installation instructions and local regulations	☐	

3.2.2 Mains Connection

	OK	Comments
Check the electrical connections at the mains side for compliance with connection drawings and local regulations.	☐	

3.2.3 DC Connection

	OK	Comments
Check the battery MCB and cables. Are their models correct?	☐	
Check the MCBs and cables at the power distribution part. Are their models correct?	☐	
Check that all cables connected to the cabinet (s) are fixed and tie wraps are properly cut (no sharp edges).	☐	

3.2.4 Battery

Inspection

	OK	Comments
Check that the correct number of cells are installed.	☐	
Check that the battery cells face the right way by measuring their polarity with a voltmeter.	☐	
Check that the battery cables are connected to the MCB with correct polarity.	☐	

Initial charging

	OK	Comments
Refer to the instructions provided by the battery supplier upon the initial charging.	☐	

3.3 Startup Preparations

3.3.1 AC Distribution Unit & Rectifiers

	OK	Comments
Make sure that the mains input MCB is set to “OFF”	☐	
The rectifier has been installed. Open the mains input MCB	☐	

3.3.2 DC Distribution Unit

	OK	Comments
Make sure that the MCBs and MCBs of all loads have been opened or removed.	☐	

3.3.3 Monitoring Module

	OK	Comments
Check that the communication and alarm cables are connected to the signal transfer board.	☐	
Check that the monitoring module is correctly installed.	☐	

3.3.4 Battery

	OK	Comments
Check that the temperature sensor, if any, has been installed.	☐	
Check that the battery group circuit is not closed.	☐	
Check that all the battery MCBs are removed.	☐	

3.3.5 BLVD

	OK	Comments
Check with an ohmmeter that there is no short circuit between the positive & negative distribution bus bars, or between the positive & negative battery poles (Note: Pull out all modules before the check and restore them after the check)	☐	

3.4 Startup

Remove metal objects that may cause short circuit, such as rings and wristwatches, etc.

3.4.1 Battery

	OK	Comments
Install the last inter-cell connector.	☐	
Measure with a voltmeter across the connection points of each battery and make sure that the polarity is right. For a lead-acid battery with 24 cells, the voltmeter should read 2.0-2.1V/cell or 48-51V/battery. If the voltage of certain cell is lower than 2.0V, that cell must be replaced.	☐	Umin=____V

3.4.2 Starting Rectifiers

	OK	Comments
Check the voltage at the mains distribution unit	☐	U= Vac
Switch on the system AC input MCB, the system operation indicator will turn on. Insert the rectifiers one by one, the green LED on the rectifier will be on and the fan will start running after a certain delay. The monitoring module will show that the power supply voltage is 53.5V.	☐	
Check the system voltage and busbar polarity with a voltmeter. The votage difference between the measured value and displayed value should be less than ±0.2V.	☐	
Switch off the mains input MCB of a rectifier. The LVD contactor will be closed.	☐	
Start and stop each rectifier of the system in the same way and check their output voltage.	☐	

3.4.3 Connecting The Battery And Rectifiers

	OK	Comments
Power all rectifiers by closing their input MCBs. The monitoring module will display the voltage as 53.5V.	☐	
Close the battery input MCB to connect the battery to the circuit.	☐	

3.5 Basic Settings

When the system is put into service for the first time, the monitoring module must be set based on the actual system configuration, battery number, capacity, user's charge current limit and other functional requirements. Only after that can the monitoring module display system operation information and control the output.

For monitoring module parameter setting method, see "Section 4.7 Setting System Parameters".

3.5.1 System Model

	OK	Comments
The system model has been set correctly in factory before delivery, check that the setting agrees with the actual system.	☐	
Set the newly-replaced monitoring module according to the actual system model.	☐	

3.5.2 Battery Number

	OK	Comments
The battery number set at the monitoring module should be the same as the number actually connected. (By default: 2)	☐	

3.5.3 Battery Capacity

	OK	Comments
Set the battery capacity according to the actual capacity of the battery connected to the system. Default: 300Ah.	☐	

3.5.4 Battery Shunt

	OK	Comments
Configure this parameter according to the actual situation. If there is a shunt, set this parameter to "Y", otherwise, "N". The monitoring module manages only the batteries that are connected to a shunt. By default: Y.	☐	

3.5.5 Temperature Compensation Coefficient

When the system is configured with a temperature sensor, the temperature compensation coefficient must be configured.

	OK	Comments
Configure the temperature coefficient according to the battery manufacturer's requirement. Setting range: 0-500mV/°C (By default: 0mV/°C).	☐	

3.5.6 Current Limit

	OK	Comments
Set the charge current limit according to your needs. Setting range: 0.1~0.25C_{10}. (By default: 0.1C_{10})	☐	

3.5.7 Floating And Boost Charge Voltages

	OK	Comments
Set the monitoring module according to the voltage suggested by the battery supplier. Floating Charge (FC) voltage range: 42V ~ Boost Charge (BC) voltage. BC voltage range: FC voltage ~ 58V. Default: 53.5V. For batteries that do not need BC, set the BC voltage to FC voltage plus 0.1V. (By default: 56.4V).	☐	

3.6 Alarm Check

Check that all functional units can trigger alarms that can be displayed on the monitoring module.

3.6.1 Rectifier Fault

	OK	Comments
Pull out one rectifier. The “Rect N Com Failure” alarm should be triggered.	☐	
Insert the rectifier in. The alarm should be cleared.	☐	
Repeat the same on other rectifiers.	☐	

3.6.2 Battery MCB Fault

	OK	Comments
Switch off the battery input MCB. The “Batt1/2 Failure” alarm should be triggered.	☐	
Switch on the MCB. The alarm should be cleared.	☐	
Repeat the same procedures to the other battery MCBs.	☐	

3.6.3 DC Load Route Disconnection Fault

	OK	Comments
Open the MCB of a DC load route. If that output is connected to a certain load, the alarm “Load N Failure” should be triggered.	☐	
Close the MCB, and the alarm should be cleared.	☐	
Repeat the same on the MCB of other load routes.	☐	

3.6.4 Under-voltage Alarm

	OK	Comments
Switch off all the battery input MCBs.	☐	
Keep only one rectifier in operation.	☐	
Through the monitoring module, adjust the rectifier FC voltage to make it lower than the alarm point. The alarm “DC Voltage Low” should be triggered.	☐	

3.6.5 Battery Protection Alarm

	OK	Comments
Keep the rectifiers in operation.	☐	
Set through the monitoring module the battery management parameter to “Manual”.	☐	
Enter the maintenance menu at the monitoring module. Select “Disconnect” and confirm it. The battery protection contactor should be open, and the “BLVD” alarm should be displayed at the monitoring module.	☐	

3.6.6 SPD Fault Alarm

	OK	Comments
Pull out the varistor of the AC SPD. The “SPD fault” alarm should be triggered.	☐	

Put the varistor back to the SPD, the alarm should be cleared.	☐

3.7 System Operation Statue Check

There should be no alarms during normal system operation. The system operation status check can be conducted through the monitoring module.

For the parameter query method, refer to “Chapter 4 Monitoring Module”.

3.7.1 AC Voltage

	OK	Comments
The monitoring module should be able to display the AC voltage.	☐	

3.7.2 DC Voltage

	OK	Comments
The monitoring module should be able to display the DC voltage. The difference between the displayed voltage and that measured at the bus bar with should be less than 1%.	☐	

3.7.3 Battery Current

	OK	Comments
The monitoring module should display the battery current while a new battery is being connected to the system or a battery is in BC mode. Calculate the battery current by measuring the voltage at the shunt (In ACTURA OPTIMA 48200 (PS48165/3200): 500A/75mV). The difference between the displayed and measured battery current should be less than 1%.	☐	

3.7.4 Rectifier Parameters

	OK	Comments
Check the number of the rectifier through the monitoring module. The number should be consistent with the actual number.	☐	
Check the voltage, current, current limiting point of rectifiers through the monitoring module. They should agree with those specified in the parameter card.	☐	

3.7.5 Ambient Temperature

	OK	Comments
For the system configured with temperature sensor, the monitoring module should be able to display the battery ambient temperature.	☐	
Hold the probe of the temperature sensor with hand and watch the monitoring module, which should diplay the change of temperature.	☐	

3.8 Final Steps

	OK	Comments
Disconnect all test equipment from the system and make sure that materials irrelevant to the equipment have been all removed.	☐	
Restore the equipment to its original condition and close the cabinet door.	☐	
Check and handover the user documents to the agent.	☐	
Check and handover spare parts that the user has purchased.	☐	
Note down all the operations taken, including time of the operation and name of the operator.	☐	

If any defect is found in this equipment, inform the personnel responsible for the contract.

If repairing is needed, please fill in the FAILURE REPORT and send the report together with the defective unit to the repairing center for fault analysis.

Chapter 4 Use Of Monitoring Module

4.1 Front Panel

There are backlit LCD display, functional keypad, indicators and positioning pin on the front panel of M500D monitoring module, as shown in the following figure:

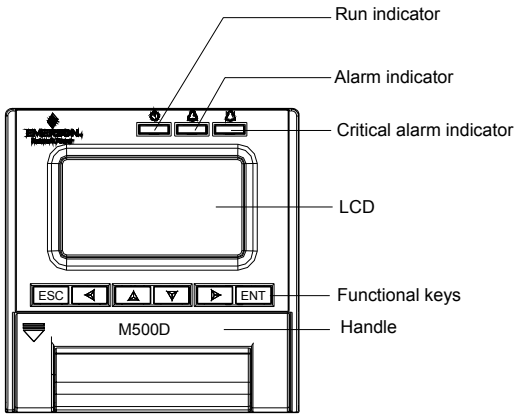


Figure 4-1 Front panel of M500D monitoring module

Description of the indicators on the front panel is in the following table:

Table 4-1 Monitoring module indicator description

Indicator	Normal state	Fault state	Fault cause
RUN (Green)	On	Off	No operation power supply
Alarm (Yellow)	Off	On	There are observation alarms
Critical alarm (Red)	Off	On	There are major or critical alarm

M500D monitoring module uses a 128 × 64 LCD, a keypad with 6 keys. The interface language is Chinese/English optional. The front panel is easy to remove and replace.

Table 4-2 Description of monitoring module keypad

Key	Function
ESC	Return to the upper level menu.
ENT	Enter the main menu or confirm the menu operation
"▲" and "▼"	Shift among parallel menus. For a character string, these 2 keys can be used to shift among different options.
"◀" and "▶"	Change values at a value setting interface. For a character string, these 2 keys can move the cursor left or right.

4.2 Power On Order

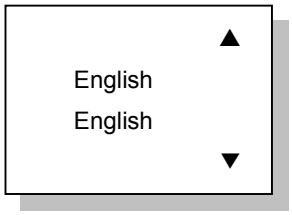
After the system is powered on for the first time, you should set the system type according to the actual configuration. The monitoring module will restart after the system type is changed. In that case, you should re-configure those parameters whose default values are inconsistent with the actual situation. Only after that can the monitoring module operate normally.

After configuring the system parameters, you can carry out various operations directly without resetting the parameter values. As for those important parameters related to battery management, such as BLVD, you should be fully aware of their influence upon the system before you change their values.

Note

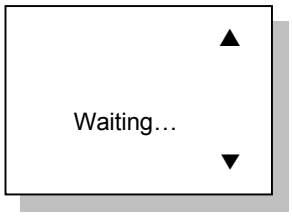
For the exact meanings of the abbreviations used in LCD displayer, see *Appendix F Glossary.*

1. The LCD will prompt you to select a language once the monitoring module is powered on.

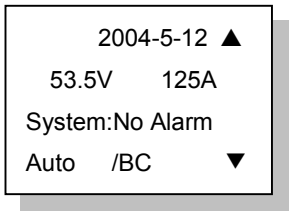


You can use "◄", "►", "▲" or "▼" to select the language you want, and press "ENT" to confirm.

2. The monitoring module will prompt you to wait, and start initialization.

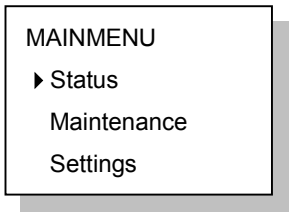


3. The first system information page appears



The system information is shown in many pages. You can repeatedly press "▼" to view other system information pages in a cycle.

4. At any system information page, press "ENT" to enter the "MAIN MENU" page, which contains 3 sub-menus: "Status", "Maintenance" and "Settings".



You can press "▲" or "▼" repeatedly to select a sub-menu, and press "ENT" to enter the sub-menu. Press "ESC" to return to the menu of higher level.

1) Status

Including rectifier information, active alarm information and alarm history information.

2) Maintenance

The maintenance operation can be conducted only when the battery management mode is set to "Manual". The maintenance includes battery FC, BC and test, load power off/on, battery power off/on and rectifier voltage trimming, current limit, switch control and resetting.

3) Settings

Including the setting of alarm parameter, battery parameter, AC/DC parameter, rectifier parameter and system parameter.

4.3 Querying System Status

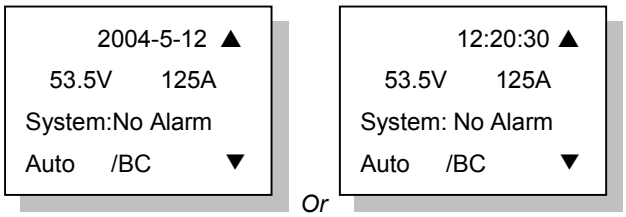
4.3.1 First Page Of System Information

1. At the main menu page, press “ESC” to return to the first system information page.

2. If no operation is conducted on the monitoring module keypad for 8 minutes, the LCD will return to the first system information page and shut down the back light to protect the screen. Pressing any key will turn on the back light.

The first system information page contains the major system operation information, including date/time, busbar voltage, total load current, system operation state (normal or alarm), battery management mode (AUTO or MANUAL) and battery state.

Among which, the battery state include FC, temperature compensation, BC, Cyclic Boost, test, short test and scheduled test. The current time are displayed in two pages shifting at the interval of 2s. One page shows year, month and date, the other shows hour, minute and second. The year is displayed with four digits; other time units are in two digits.



Note

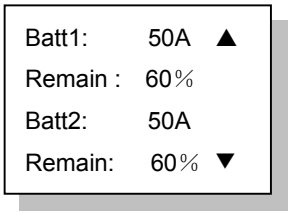
1. At this page, you may use “◄” and “►" to adjust the LCD contrast (7-level).

2. If there has been no keypad operation for 8 minutes, the monitoring module will return to the first system information page. The time of that return will be recorded automatically, and can be queried through the host.

4.3.2 Other System Information Pages

The system information is shown in many pages. The default page of the monitoring module after the system power on is the system information first page. You can press “▲” or “▼” to scroll up or down to view more operation information, as shown in the following page:

Battery information page



1. Battery 1, battery 2

They represent respectively the current of the battery that battery shunt 1 and shunt 2 is connected to. If the “Shunt Coeff” of a certain battery group is set to “No”, this situation will be reflected at the battery information page by “Not connected”, and no actual capacity will be displayed.

2. Actual battery capacity

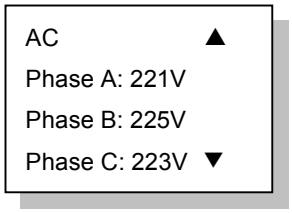
The monitoring module can approximately calculate the remaining battery capacity in real time. Through configuration at the host, the remaining battery capacity can be displayed in the mode of percentage, remaining Ah or remaining time, etc. The default is the percentage.

During the normal BC/FC management, the monitoring module regards the rated capacity as the capacity that each battery group can reach. When the battery discharges, the monitoring module will calculate the battery remaining capacity according to the discharge current, discharge time and the preset “battery discharge curve”. When the battery is being charged, the monitoring module will calculate the real-time battery capacity according to the detected charge current, charge time and preset “battery charge efficiency”. If the calculated battery remaining capacity is

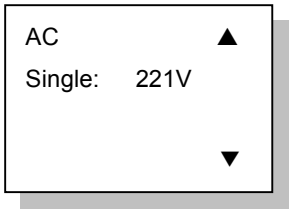
higher than the rated capacity, the monitoring module will automatically change the calculated battery remaining capacity to the rated capacity.

AC information page

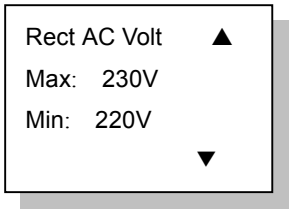
1. If the power system is a 3-phase input system with manual-switchover between 2 AC inputs, the voltage of the three phases will be displayed.



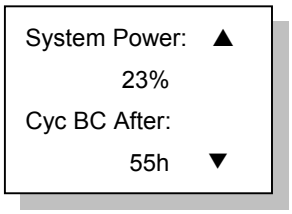
2. If the power system is a 1-phase input system with manual-switchover between 2 AC inputs, the single-phase voltage will be displayed.

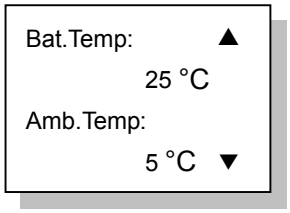


3. If there is no AC sampling board in the power system, the LCD will display the max and min AC input voltages of all rectifiers.



BC prompt and temperature information page





If the monitoring module bans BC and no temperature sensor is configured, this page will not be displayed.

The first line of the information page displays the BC prompts, which will be different with different systems, including:

1. Prompt the time of next Cyclic Boost according to the battery state
2. If BC is going on, the “Charging” will be prompted
3. If BC is disabled, this row will be empty

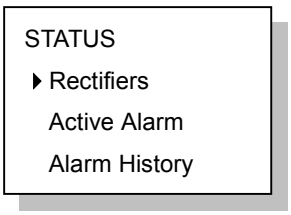
The 2nd and 3rd rows of the page are the temperature information detected by the temperature sensor. The display will vary with different parameter settings (see 4.7 for parameter setting). If the temperature sensor is not connected or is faulty, system will prompt invalid. Meanwhile, the 4th row will display “Check Temp Sensor”.

4.4 Querying Rectifier Status

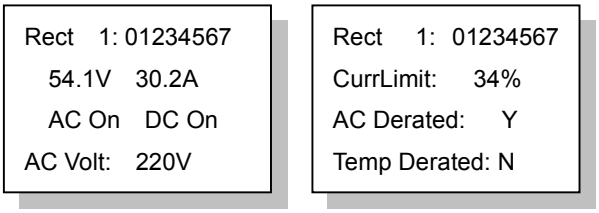
The rectifier information includes the rectifier serial No., voltage, current, current limit, mains situation, rectifier power limit and temperature power limit.

1. At any page of the system information, press “ENT” to enter the main menu.

2. Use “▲” or “▼” keys to select the “Status” sub-menu in the main menu, and press “ENT” to confirm.



3. Use “▲” or “▼” to select the “Rect Info” submenu, as shown in the above figure. Press “ENT” to confirm.



The information of every rectifier is displayed in two pages. The information in the first page includes: rectifier serial No., output voltage and current, AC/DC on/off state and AC input voltage. The information in the second page includes: rectifier serial No., current limit, the states of “AC Derated” and “Temp Derated”. Press “►” to scroll to the next page, or “◄” to return to the last.

4. Press “▼” or “▲” to query other rectifier’s information.

At most 48 pieces of rectifier’s information can be displayed. If the rectifier does not exist, there will be no information. If the rectifier communication is interrupted, the information will be displayed in high light.

5. At any rectifier information page, press “ESC” repeatedly and you can return to the higher-level menus.

4.5 Querying Alarms And Setting Alarm Plans

The monitoring module can locate and record the system fault according to the collected data, as well as raise audible/visual alarms and output through dry contact according to the preset alarm level. Meanwhile, it reports the alarms to the host.

You can query historical alarms and active alarms through the LCD of the monitoring module.

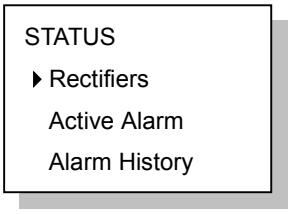
4.5.1 Querying Active Alarm

When a new alarm is raised, and there is no operation on monitoring module keypad within 2 minutes, the LCD of the monitoring module will prompt automatically the active alarm.

If there are multiple alarms in the current system, you can query alarms through the following steps:

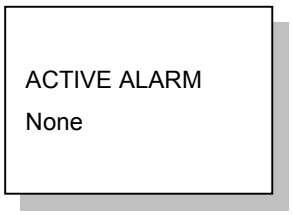
1. At any system information page, press “ENT” to enter the main menu

2. Use “▲” or “▼” to select the “Status” submenu in the main menu and press “ENT” to confirm

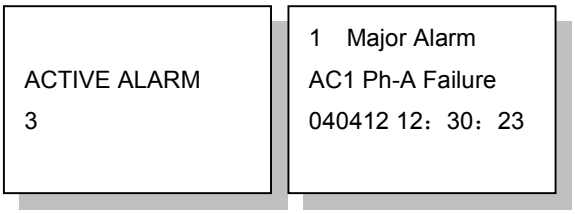


3. Press “▲” or “▼” to select the “Active Alarm”, as shown in the above figure, and press “ENT” to confirm.

1) If there is no active alarm, “Active Alarm: None” will be displayed

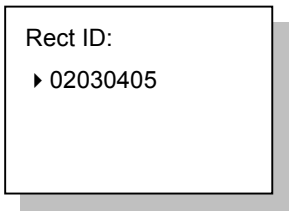


2) If there is any alarm, the display will be like the following:

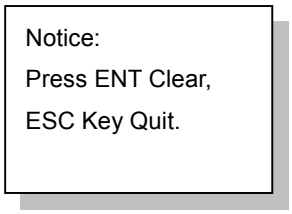


The information in the active alarm information pages includes: alarm serial No., alarm level, alarm name and time (year, month, day, hour, minute and second). The alarm raising time determines the sequence it is displayed, with the latest alarm displayed first. Use "▲" or "▼" to view all active alarms.

While querying rectifier alarms, press "►", and the rectifier ID will be displayed, and the "Run" indicator of the corresponding rectifier will blink.



In the case of battery test alarm or maintenance time alarm, press "►" to display the prompt information.



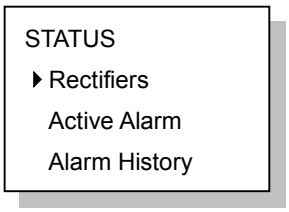
In the prompt page, press "ENT" to confirm the alarm.

4. At any active alarm information page, press "ESC" repeatedly and you can return to the higher-level menus.

4.5.2 Querying Alarm History

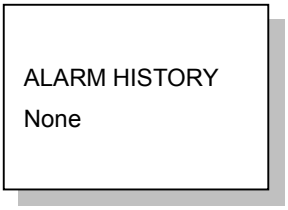
1. At any system information page, press "ENT" to enter the main menu

2. Press "▲" or "▼" to select the "Status" submenu, and press "ENT" to confirm.

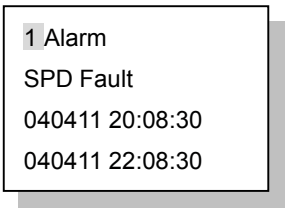


3. Use "▲" or "▼" to select the "Alarm History", as shown in the above figure and press "ENT" to confirm.

If there is no historical alarm, the prompt will be "Alarm History: None".



The historical alarms of the monitoring module are stored in cyclic order. Up to 200 alarms will be recorded. Above that, the earliest alarm will be cleared automatically.



At the monitoring module, the displayed historical alarm information includes: alarm serial No., alarm name and alarm start/end time (year, month, day, hour, minute, second).

If it is a rectifier that raised the alarm, the ID of that rectifier will be displayed.

4. At any Alarm History information page, press “ESC” repeatedly to return to the higher-level menus.

4.5.3 Alarm Type Table

The alarm type table of the system is as follows.

Table 4-3 Alarm type table

Serial No.	Alarm	Description	Default alarm level	Default related relay	Related parameter configuration
1	SPD Fault	The SPD circuit is faulty	Critical	8	
2	Digit Input Fault	The alarm name is user defined, not longer than 10 characters. The high/low level alarm can be set in the alarm mode.	No alarm	None	you can name 8 routes
3	DC/DC Failure	Including DC/DC converter fault	Critical	None	
4	AC Over Volt	The system AC input voltage is higher than the set value of parameter “OverVolt”	Critical	None	Over-voltage alarm
5	Ph-X Volt Low	The system AC input voltage is lower than the set value of parameter “LowVolt”	Critical	None	Under-voltage alarm
6	Power Failure	In single AC input system or double-AC manual-switchover system, the AC voltage of all rectifiers are lower than 80V	Major	1	
7	DC Voltage High	System DC output voltage is higher than the set value of parameter “Temp Threshold: Over”	Critical	2	Over-voltage alarm
8	DC Under-volt	System DC output voltage is lower than the set value of parameter “Temp Threshold: Under”	Critical	2	Under-voltage alarm
9	DC Voltage Low	System DC output voltage is lower than the set value of parameter “Temp Threshold: Low”	Observation	2	Low-voltage alarm
10	Batt Overtemp	Battery temperature is higher than the set value of parameter “Temp Threshold: Over Temp”	Major	None	Over-temperature alarm point
11	Batt Temp High	Battery temperature is higher than the set value of parameter “Temp Threshold: High Temp”	Observation	None	High temperature alarm point
12	Batt Temp Low	Battery temperature is lower than the set value of parameter “Temp Threshold: Low Temp”	Observation	None	Low temperature alarm point
13	Amb Temp High	Ambient temperature is higher than the set alarm point	Observation	None	
14	Amb Temp Low	Ambient temperature is lower than the alarm point	Observation	None	
15	No TempSensor1	Temperature sensor 1 has been set, but no sensor is actually connected	Critical	None	
16	No TempSensor2	Temperature sensor 2 has been set, but no sensor is actually connected	Critical	None	

Serial No.	Alarm	Description	Default alarm level	Default related relay	Related parameter configuration
17	TempSensor1 Err	Temperature sensor 1 detected unreasonable temperature	Critical	None	
18	TempSensor2 Err	Temperature sensor 2 detected unreasonable temperature	Critical	None	
19	LLVD	1. Load disconnection 2. Manual load disconnection	Critical	5	LLVD enabled
20	BLVD	1. When battery discharges till its voltage is lower than the “BLVD Volt”, or the discharge time is longer than the “BLVD Time”, the BLVD contactor will be open automatically 2. BLVD through manual operation	Critical	4	BLVD enabled
21	Load 1 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
22	Load 2 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
23	Load 3 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
24	Load 4 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
25	Load 5 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
26	Load 6 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
27	Load 7 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
28	Load 8 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
29	Load 9 Faiure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	6	
30	Aux Load Fails	The last route faulty	Critical	6	
31	Batt1 Failure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	None	
32	Batt2 Failure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	None	
33	Batt3 Failure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	None	
34	Batt4 Failure	Over-load, short circuit, manual disconnection or alarm circuit faulty	Critical	None	
35	Batt1 Over-curr	The charge current of battery group 1 is bigger than the set value of parameter “Over”	Observation	None	
36	Batt2 Over-curr	The charge current of battery group 2 is bigger than the set value of parameter “Over”	Observation	None	
37	Rect Vac Err	All AC voltages are lower than the AC low-volt point	Major	3	
38	Rect Over Temp	Rectifier internal temperature higher than 90°C	Observation	None	
39	Rect Failure	Rectifier over-voltage, higher than rectifier high threshold	Critical	3	
40	Rect Protect	AC over-voltage (⩾295V) or under-voltage (⩽80V)	Observation	3	
41	Rect Fan Fails	Fan faulty	Major	3	
42	Rect PowerLimit	AC voltage lower than 176V, with rectifier internal higher than 85°C or temperature at inlet higher than 45°C	Observation	3	
43	Rect Com Failure	Rectifier and monitoring module communication interrupted	Major	3	
44	Multi Rect Fail	More than 2 rectifiers raised alarms	Critical	None	
45	Self-detect error	Error is detected through hardware self-detection	No alarm	None	
46	Manual Mode	Battery management in the manual state	No alarm	None	

Serial No.	Alarm	Description	Default alarm level	Default related relay	Related parameter configuration
47	Non-FC Status	Including auto-BC, Cyclic Boost, constant current test and short test	No alarm	7	
48	Batt Discharge	Battery being discharging	No alarm	None	
49	Curr Imbalance	In a system with load shunt, the detected load current plus battery current differs sharply from the rectifier output current	No alarm	None	Not existent in this power system series
50	Batt Test Error	Battery discharge time unexpectedly short	Observation	None	
51	Short Test Fault	During the short test, the two batteries discharged more than the set value	Observation	None	
52	Outvolt Fault	The maintenance FC voltage different from the busbar voltage, or the reported data. The difference is more than 1V	Observation	None	
53	System Maintain	The pre-set system maintenance time is due	Observation	None	
54	Alarm Block	Alarms sent to the host are blocked, valid in EEM-M protocol	No alarm	None	

4.5.4 Changing Audible/Visual Alarm And Alarm Call Back Plan

There are different audible/visual alarms and call back modes for alarms of different levels. For the products in China market, the alarming mode for major alarms and critical alarms are the same.

Table 4-4 Different alarms and call back modes for different alarm levels

Alarm level	Red indicator	Yellow indicator	Alarm horn	Call back	Remark
Critical	ON	/	ON	Y	Callback No. can be set
Major	ON	/	ON	Y	Callback No. can be set
Observation	/	ON	OFF	N	
No alarm	OFF	OFF	OFF	N	

Therefore, changing the alarm level of different alarms may change their audible/visual alarm mode and call back plan too.

Pressing any key on the monitoring module can silence the alarm sound. The sound will disappear and alarm indicator will be off when all alarms are cleared.

You can configure how long an alarm sound will last, or choose to make no alarm sound. For details, see *4.7.11 Alarms Settings.*

4.5.5 Changing Alarm Types Of Dry Contacts

As one of the alarm type parameter, “Related Relay” refers to the serial No. of the dry contract corresponding to the alarm type, whose value is either 1 ~ 8 or “None”. “None” means there is no corresponding dry contact. For details, see *4.7.11 Alarm Settings*.

4.6 Maintenance

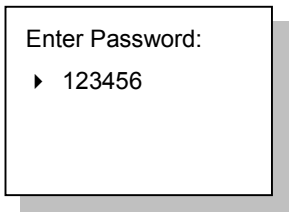
Note

1. This operation can be conducted only when the battery management is set to “Manual”.
2. Be careful! BLVD operations may result in power interruption.

1. At any information page, press “ENT” to enter the main menu.
2. Press “▼” to select the “Maintenance” menu.

You cannot enter the system Maintenance menu if the “Battery Management” is set to “Auto”.

3. Press “ENT” and input the correct operation password. Press “ENT” again to enter the “Maintenance” menu.



To input the password, use “▲” or “▼” to modify numbers, and use “◄” or “►” to move the cursor. After the input, press “ENT” to confirm.

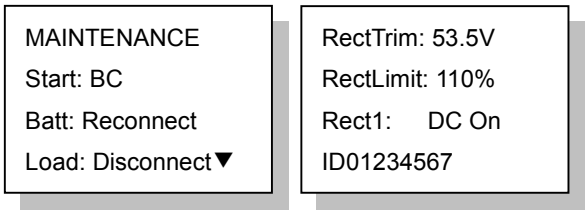
If the password is incorrect, system will prompt “password incorrect”. If the password is less than 6 digits, end it with a “#”.

Note

You can choose to enter the “Maintenance” menu by using either the user, operator or administrator password, for in this menu, all users have the same authority.

4. Press “▲” or “▼” to scroll to the operation page you need.

There are two pages:



5. Press "◄" and "►" to select the needed action.

“Start”: The options include “FC”, “BC” and “Test”. If system is not configured with any battery, the control would be invalid. If there is AC power off alarm, or the busbar voltage is too low, the BC and battery test control will not be executed by the system. No battery test control can be conducted when the rectifier communication is interrupted. Finally, after the battery test, the battery management mode will be changed from “Manual” to “Auto” automatically.

“Battery”: The options include “Reconnect” and “Disconnect”. If there is no battery, or there is a battery alarm, the battery operations will be invalid.

“Load”: The options include “Reconnect” and “Disconnect”.

The following maintenance over the rectifier can be conducted only when the power system is in the FC state.

”RectTrim”: Range: 42V ~ 58V. It can be used to improve the current sharing among rectifiers. Note that the value of this parameter cannot exceed the over-voltage alarm point, or the parameter will be invalid.

”RectLimit”: Range: 10% ~ 121%.

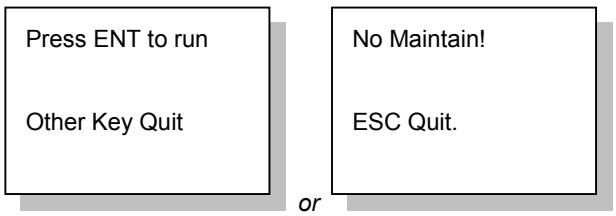
The maintenance operations over a single rectifier include: “DC ON/OFF”, “AC ON/OFF” and “Reset”. The operation method is:

1) Use “▲” or ” ▼” to select the rectifier parameter, and “◄” or “►” to change the rectifier serial No. Then press “ENT” to confirm. The bottom line of the page displays the rectifier ID.

2) Use “▲” or “▼” to move the cursor to the maintenance operation area, and “◄” or “►” to select the value.

If the rectifier voltage is too high, you can select “Reset” to restore the output voltage of that rectifier to normal.

6. There will be prompts as the confirmation of control commands. If the maintenance operation is valid, system will prompt you press “ENT” to confirm and execute the operation, or “ESC” to abort the operation. Otherwise, system will prompt you the operation is invalid, and press “ESC” to quit.



or

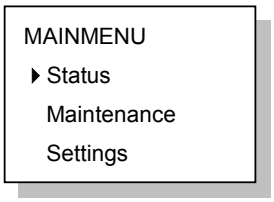
Press “ESC” to return to the menu of higher level.

4.7 Setting System Parameters

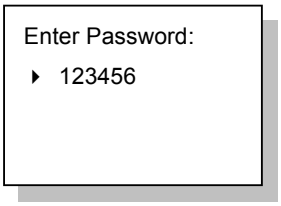
Battery parameters are very important, for they are related to the life of battery. Before delivery, the battery parameters have been initialized. Without any special needs, you only need to reset the battery group number and battery capacity, and accept the defaults for other parameters.

4.7.1 Parameter Setting Method

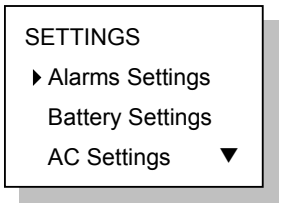
1. At any system information page, press “ENT” to enter the main menu.

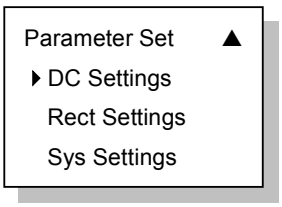


2. Use “▲” or “▼” to select the submenu “Settings” and press “ENT” to confirm. System will then prompt you to input the password.



3. Press "◄" or "►" to select the number of password digits. Enter the password digit by digit using “▲” or “▼”. Press “ENT” to confirm and enter the parameter setting submenu.





Users with different password levels have different authorities. See the following table:

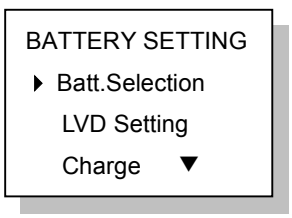
Table 4-5 Different password levels and relevant different authorities

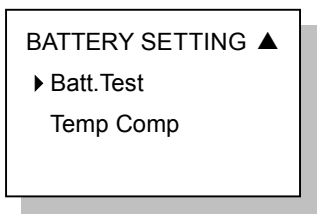
Level	Authority	Default password
User	Configuration of general parameters	1
Operator	User’s authority, plus resetting system, resetting password and modifying system type.	2
Administrator	Operator’s authority, plus modifying password of all levels, controling alarm sound volume, browsing system parameters that can be set only through the host	640275

4. There are two pages of “Settings”. Shift page by using “▼” or “▲”, and select the parameter by using “▼” or “▲”. Press “ENT” to confirm.

As shown in the above figure, the monitoring module divides the parameters to be set into 6 kinds: alarms parameter, battery parameter, AC parameter, DC parameter, rectifier parameter and system parameter.

Among which, the battery parameters are divided into 5 kinds: basic, BLVD, charging management, battery test, temperature coefficient, and they are displayed in two pages, as shown below:

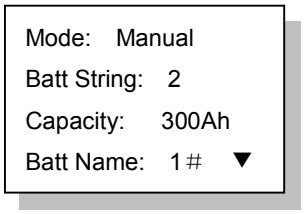




What follows is the description of the parameter functions and values by dividing them into 5 small categories and 5 big categories.

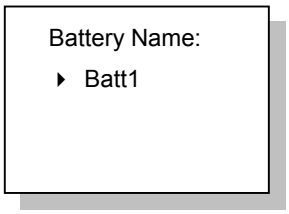
4.7.2 Battery Selection

1. The first page of the Battery Selection is shown below:



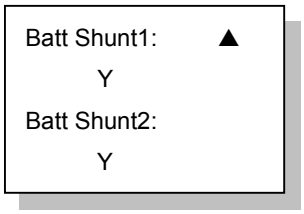
Use "▼" or "▲" to select the page and the parameter to be set, and "◄" or "►" to select the proper value for the parameter. Press "ENT" to confirm.

After setting the "Battery Type", the following prompt will appear, asking you to name a certain type of battery for the sake of identifying them:

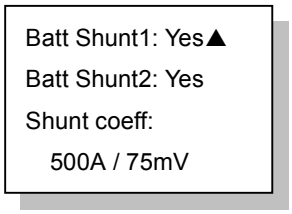


To name a rectifier, you can use "▲" or "▼" to change the number, and "◄" or "►" to move the cursor left or right. Press "ENT" to confirm afterwards.

2. If setting parameter "System Type" does not require setting the battery shunt coefficient, the second page of the basic battery settings is as follows:



3. If setting parameter "System Type" requires setting the battery shunt coefficient, the second page of the basic battery settings is as follows:



4. The value description of the basic battery parameters is listed below:

Table 4-6 Basic battery parameters descriptions

Parameter	Range	Defaults	Value description
Mgmt Mode (Management mode)	Auto, Manual	Auto	In normal situation, it should be in the "Auto" mode, which enables the monitoring module manage the whole power system automatically, including: Automatic FC/BC switchover, LLVD and BLVC. In the manual mode, you can do operations like BC, FC, test and battery on/off, as well as enabling automatic battery BC time protection and capacity calculation. Upon the system DC under-voltage alarm, system can automatically switch to the "Auto" mode, lest wrong manual operation should damage the system.
Batt String (number of battery strings)	0 ~ 4	4	You should set this parameter according to the actual battery configuration. If "Batt Shunt" is set as "Y", there should be batteries actually configured.
Rated AH (rated capacity)	50 ~ 5000Ah	300Ah	The capacity of a single battery string. You should set this parameter according to the actual battery configuration.
BTT Name	1# ~ 11#	1#	
Battery Name	10 characters		Name different battery types to identify them

Parameter	Range	Defaults	Value description
Batt Shunt1	Yes, No	Yes	Select “Y” when a corresponding shunt is configured, otherwise, select “N”. Battery management aims at only the batteries connected to the shunt
Batt Shunt2		No	
Shunt Coeff (shunt coefficient)	Dependent on system type		In the system type setting, if the parameter “Shunt” is set to “Y”, this parameter will be displayed. Otherwise this parameter will take the default value, and is the same for both battery strings.

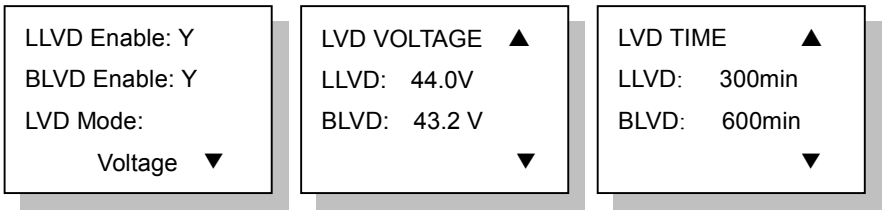
4.7.3 LVD Parameter Description

1. Function description

LLVD means the monitoring module opens the LLVD contactor, so that the non-priority load will be powered off. In this way, the battery remaining capacity can sustain the priority load longer.

BLVD means the monitoring module opens the BLVD contactor. In this way, the battery will stop powering the load, preventing over-discharge.

2. There are 3 related pages, as shown below:



Use “▼” or “▲” to select one page or one of the parameters, and “◄” or “►” to select the parameter value. Press “ENT” to confirm and save.

Note

Generally you do not need to set the LVD parameters’ value. The defaults will do.

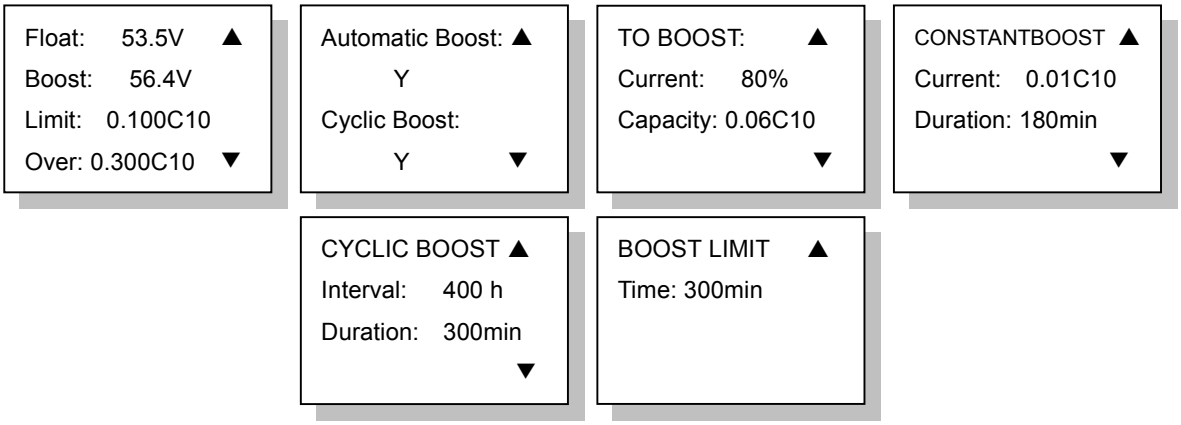
3. The value description of the LVD parameters is listed below.

Table 4-7 LVD parameters description

Parameter	Range	Default	Value description
LLVD Enable	Y, N	Y	Select “Y” to enable LLVD function
BLVD Enable			Select “Y” to disable the BLVD function
LLVD Mode	Time, voltage	Voltage	Select “Voltage”, when the monitoring module detects that the battery voltage is lower than the prestet “LLVD Volt”, the load will be disconnected, and so is the battery when the battery voltage is lower than the preset ‘BLVD Volt”. Select “Time”, when the discharge time reaches the preset “LLVD Time”, the monitoring module will disconnect the load; when the discharge time reaches the preset “BLVD Time”, it will disconnect the battery.
LLVD Volt	40V ~ 60V	44.0V	
BLVD Volt		43.2V	
LLVD Time	3 ~ 1,000 min	300min	
BLVD Time		600min	

4.7.4 Charging Management Parameters

1. There are 6 related pages, as shown below:



Use "▼" or "▲" to select one page or one of the parameters, and "◄" or "►" to select the parameter value. Press "ENT" to confirm and save.

Note

Generally you do not need to set the management value. The defaults will do.

2. The charging management parameter value description is listed below:

Table 4-8 Charging management parameter value description

Parameter	Range	Default	Value description	
Float	42V ~ 58V	53.5V	In the FC state, all rectifiers output voltage according to the set "Float"	The "Boost" must be higher than the "Float"
Boost		56.4V	In the BC state, all rectifiers output voltage according to the set "Boost"	
Limit (current limit)	0.1 ~ 0.25C_{10}	0.1C_{10}	When the monitoring module detects that the battery charging current is higher than the "Limit", it will control the current of the rectifiers, through which it can limit the battery charging current. C_{10} is the battery rated capacity, generally set to 10 ~ 20% of of the rated capacity of one battery string.	
Over (over current point)	0.3C_{10} ~ 1.0C_{10}	0.300C_{10}	When the monitoring module detects that the battery charging current is higher than the "Over", it will raise the battery charge over-current alarm.	
Automatic Boost	Yes, No	Y	Select "Y", and BC will be conducted when conditions allow	
Cyclic Boost			Select "Y", and the monitoring module will control the system to enter the Cyclic Boost when the FC time reaches the "Cyclic Boost Interval". The battery charging voltage is the preset "Boost", and the time is the preset "Cyclic Boost Time"	
Cyclic Boost Interval	48 ~ 8760h	2400h		
Cyclic Boost Time	30 ~ 2880min	720min		
To Boost Current	0.050 ~ 0.080C_{10}	0.06C_{10}	The monitoring module will control the system enter the BC state when the battery capacity decreases to the value of "To Boost Capacity", or when the charge current reaches the "To Boost Current". The charge voltage will be the "Boost".	
To Boost Capacity	10% ~ 99%	80%		
Constant BC Current	0.002 ~ 0.02 C_{10}	0.01C_{10}	The system in the BC state will enter the FC state when the charge current decreases to the "Constant BC Curr" and after the "Duration". The battery charge voltage then will be the "Float".	
Duration (of constant BC)	30 ~ 1440min	180min		
Boost Limit	60 ~ 2880min	1080min	To ensure safety, the monitoring module will forcefully control the system to enter the FC state if during the BC state, the BC time reaches the "Boost Limit", or abnormalities occur (such as AC failure, battery route faulty, and rectifier communication failure etc.).	

3. The BC/FC switchover diagram is shown below:

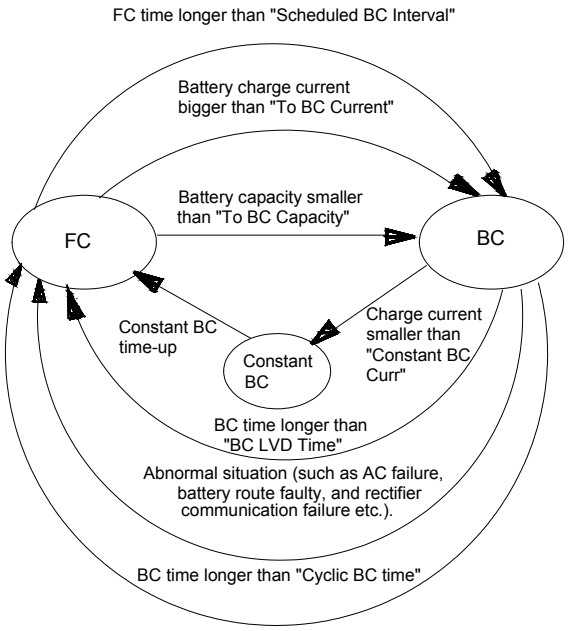
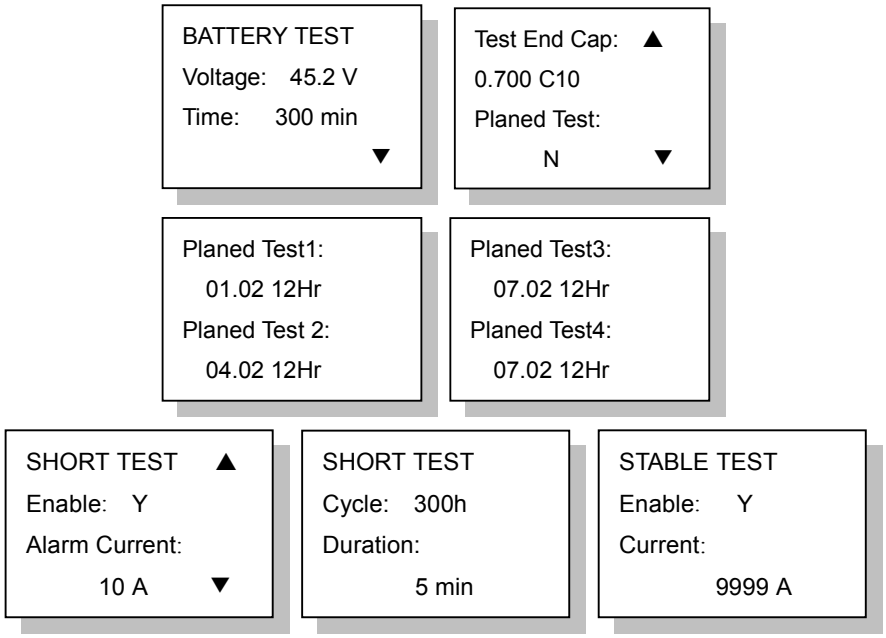


Figure 4-2 BC/FC switchover diagram

4.7.5 Battery Test Parameters

1. There are seven related pages, as shown below:



Use "▼" or "▲" to select one page or one of the parameters, and "◄" or "►" to select the parameter value. Press "ENT" to confirm and save.

2. The value description of the parameters is listed below:

Table 4-9 Battery test parameters description

Parameter	Range	Default	Value description
Battery test voltage	43.1V ~ 57.9V	45.2V	The monitoring module can do battery test, and record 10 sets of test data (accessible only through the host). The battery test has to be started manually, then monitoring module will control the rectifier output voltage, make it lower than the battery voltage, and the battery discharge will begin. Monitoring module will stop the test if the battery voltage reaches the "Battery test voltage", or the discharge time reaches "Battery test time", or the battery capacity reaches "Test End Cap". Afterwards, it will restore the rectifier output voltage to the normal FC voltage, begin the battery charge and switch the system to battery auto-management. Meanwhile the test start time/voltage and end time/voltage and battery remaining capacity will be recorded. The records can be queried through the host. During the battery test, if abnormalities occur, the monitoring module will stop the battery test automatically.
Battery test time	5 ~ 1440min	300min	
Test End Cap (capacity)	$0.01C_{10}$ ~ $0.95C_{10}$	$0.7C_{10}$	
Scheduled Test	Y, N	N	When the parameter "Scheduled Test" is set to "Y", the monitoring module will test the battery according to the 4 sets of test time. You can set at most 12 sets of test time through the host.
Planned Test 1	Month,day, hour	00:00, Jan. 1st	
Planned Test 2		00:00, April 1st	
Planned Test 3		00:00, July 1st	
Planned Test 4		00:00, Oct. 1st	
Alarm Current	1A ~ 100A	10A	If the battery have not discharged within the "ShortTest Cycle", the monitoring module will start a short test, whose operation time is set by the parameter "ShortTest Duration". By the end of the test, if the difference in the discharge currents of batteries is bigger than the "Alarm Current", the battery discharge imbalance alarm will be raised. This alarm will automatically end after 5min of delay. Also you can end it by confirming it.
ShortTest Cycle	24h ~ 8,760h	720h	
ShortTest Duration	1 ~ 60min	5min	
StableTest Enable	Y, N	N	The stable test is conducted with constant battery current, whose value is set through the parameter "StableTest Current". If the parameter "StableTest Enable" is set to "Y", and the test will be started once the battery satisfies the test condition
StableTest Current	0 ~ 9999A	9999A	

3. The schematic diagram of the test function is shown below:

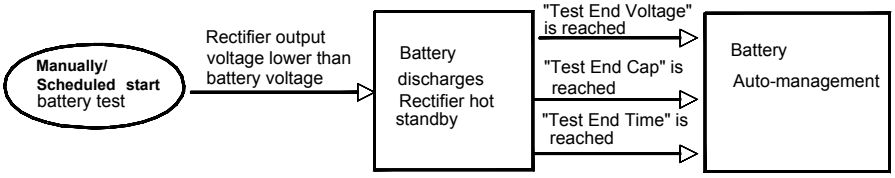
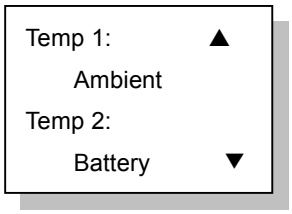


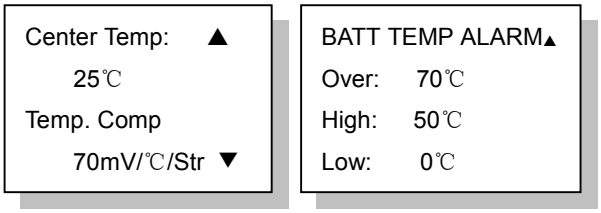
Figure 4-3 Schematic diagram of the test function

4.7.6 Temperature Compensation Coefficient Parameters

1. The first page of the setting interface is shown below:



2. If the "Temperature1" or "Temperature2" is set to "Battery Temp", you need to set the following parameters:



Use "▼" or "▲" to select one page or one of the parameters, and "◄" or "►" to select the parameter value. Press "ENT" to confirm and save.

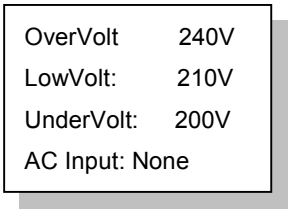
3. The value description of the parameters is listed below:

Table 4-10 Temperature compensation coefficient parameters description

Parameter		Range	Default	Value description	
Temperature1		Ambient Temp, None, Battery Temp	None	The "Ambient Temp" and "Battery Temp" refer to the measurement of the ambient or battery temperature sensor at the local power system. "None" means there is no measurement input. You should set this parameter according to the actual situation. The temperature measurement data will be displayed in the system operation information screen.	
Temperature2					
When Temperature1 or Temperature 2 is set to "Battery Temp"	Center Temp	10°C ~ 40°C	25°C	Batteries are sensitive to temperature. To ensure battery's capacity and life, its FC voltage should change together with the temperature: lower FC voltage for higher temperature, and vice versa. △FC = BattTemp – Center Temp × Temp Comp Upon alarms such as "Rect Com Failure", "DC Under-volt" and "DC Voltage High", the monitoring module will not do temperature compensation to the battery FC voltage. Set this parameter according to the actual battery technical parameters	
	Temp Comp	0 ~ 500mV/°C	72mV/°C		
	Over	10°C ~ 100°C	50°C	When the detected battery temperature is higher than the "Over", the monitoring module will raise an alarm	The "High" must not be higher than the "Over"
	High	10°C ~ 100°C	50°C	When the detected battery temperature is higher than the "High", the monitoring module will raise an alarm	
	Low	-40°C ~ 10°C	0°C	The monitoring module will raise an alarm when the detected battery temperature is lower than the "Low"	

4.7.7 AC Settings

1. The configuration interface is shown below:



Use "▼" or "▲" to select one page or one of the parameters, and "◄" or "►" to select the parameter value. Press "ENT" to confirm and save.

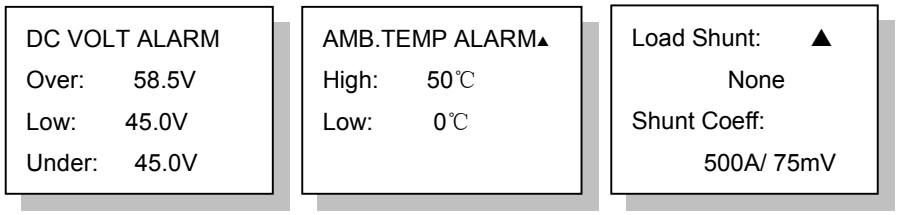
2. The value description of the parameters is listed below:

Table 4-11 AC Setting parameter description

Parameter	Range	Default	Value description	
OverVolt	50V ~ 300V	280V	The monitoring module will raise an alarm when the AC input voltage is higher than the "OverVolt"	The "OverVolt" must be higher than the "LowVolt". To avoid alrm disorder, it is suggested to use the default values
LowVolt	50V ~ 300V	180V	The monitoring module will raise an alarm when the AC input voltage is lower than the "LowVolt".	
AC Input	3-phase, Single Phase, None	Dependat on system type	Set this parameter according to the actual situation. In a system with an AC sampling board, you can only select "Single Phase" or "3-phase"; in a system without an AC sampling board, you can select only "None".	

4.7.8 DC Settings

1. There are three related pages, as shown below:



Use "▼" or "▲" to select one page or one of the parameters, and "◄" or "►" to select the parameter value. Press "ENT" to confirm and save.

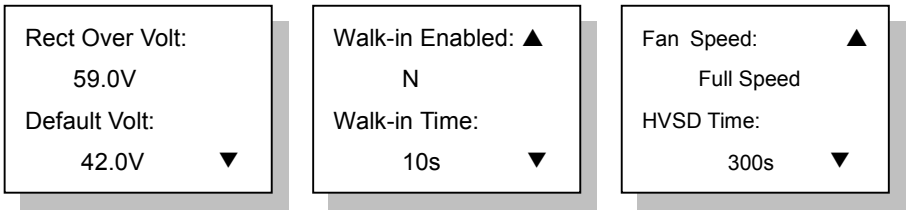
2. The value description of the parameters is listed below:

Table 4-12 DC setting parameter description

Parameter	Range	Default	Value description	
Over (over-voltage)	40V ~ 60V	58.5V	The "DC Over Voltage" alarm will be raised when the system DC output voltage is higher than the value of "Over"	The values of these three parameters should be: Over > Low > Under
Low (low-voltage)		45.0V	The DC low voltage alarm will be raised when the system DC output voltage is lower than the value of "Low"	
Under (under-voltage)		45.0V	The DC under voltage alarm will be raised when the system DC output voltage is lower than the value of "Under"	
High (high temperature)	10°C ~ 100°C	40°C	The high temperature alarm will be raised when the detected ambient temperature is higher than the value of "High"	The value of parameter "High" must be higher than that of parameter "Low"
Low (low temperature)	-40°C ~ 10°C	-5°C	The low temperature alarm will be raised when the detected ambient temperature is lower than the value of "Low"	
Load shunt	Y, None	None	Set according to the system actual situation	
Shunt Coeff	Dependent on system type		In the system with a load shunt, this parameter can be set only when the parameter "Shunt" (as a system type) is set to "Set".	

4.7.9 Rectifier Settings

1. There are three related pages, as shown below:



Use "▼" or "▲" to select one page or one of the parameters, and "◄" or "►" to select the parameter value. Press "ENT" to confirm and save.

2. The value description of the parameters is listed below:

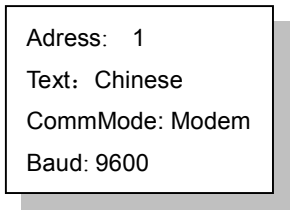
Table 4-13 DC rectifier parameter description

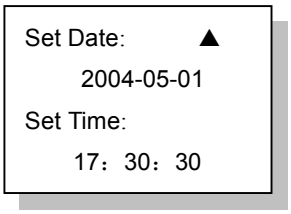
Parameter	Range	Default	Value description	
Rect Over Volt	56V ~ 59V	59V	The rectifier over voltage alarm will be raised when the rectifier output voltage is higher than the "Rect Over Volt"	The "Default Volt" must be lower than the "Rect Over Volt"
Default Volt	48V ~ 58V	53.5V		
Walkin Enabled	Y, N	N	The output soft start function means the rectifier voltage will rise from 0V to the "Default Volt" after the "Walkin Time"	
Walkin Time	8s ~ 128s	8s		
Fan Speed	Full Speed, Half Speed	Half speed	When set to "Half Speed", the rectifier will regulate the fan speed according to the temperature. When set to "Full Speed", the fan will operate at full speed	
HVSD Time	50s ~ 300s	300s	The rectifier will shut off automatically upon over-voltage, and restart after a certain delay to see whether it is still over-voltage then. That delay is set through the parameter "HVSD Time". If the rectifier's output voltage is normal within the delay, the rectifier is regarded normal; otherwise, the rectifier will be locked out and auto-restart function will be disabled.	

4.7.10 System Settings

Users of different password levels have different authorities.

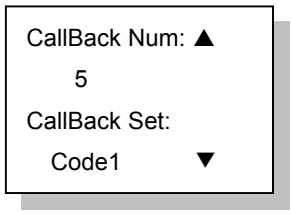
1. For the user level password (“1” by default), there are 2 related pages, as shown below:

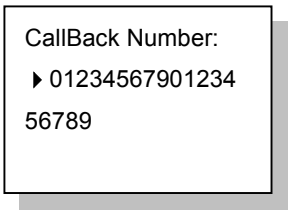




Use “▼” or “▲” to select one page or one of the parameters, and “◄” or “►” to select the parameter value. Press “ENT” to confirm and save.

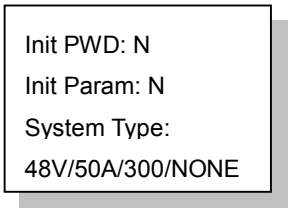
When the “CommMode” is “modem” or “EEM-M”, the “CallBack Number” and “CallBack Num” (how many times should callback be made) should be set.



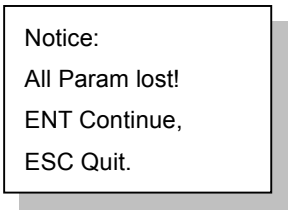


Use “▼” or “▲” to change the number, and “◄” or “►” to move the cursor left or right. Press “ENT” to confirm.

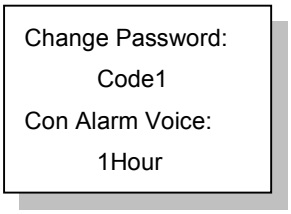
2. For the operator level password (by default: 2) or administrator level password (by default: 640275), you can see the following pages, besides the pages above, as shown below:

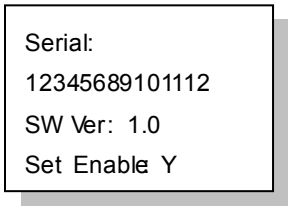


There will be a prompt when resetting the system:

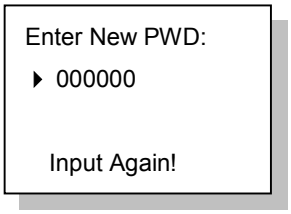


3. For administrator level password (by default: 640275), you can see the following pages, besides all those above, as shown below:





You can change the value of the parameter “Change Password” and press “ENT” to confirm.



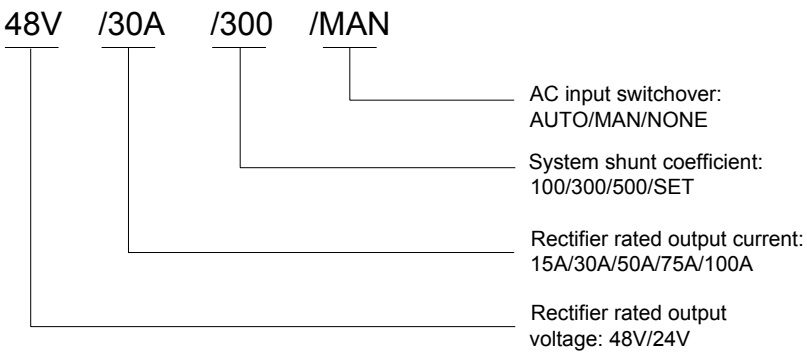
Use "▼" or "▲" to change the number, and "◄" or "►" to move the cursor left or right. Press "ENT" to confirm. You should input the same number twice to complete the setting.

4. The value description of the parameters is listed below:

Table 4-14 System setting parameter description

Parameter		Range	Default	Value description
Text		Chinese, English and Spanish	Chinese	Set according to your need
Address		1 ~ 254	1	The addresses of power systems that are at the same monitored office should be different
CommMode		modem, EEM-M, RS-232	RS-232	"MODEM": Through modem and based on the Telecom protocol. "EEM-M": Through modem and based on the EES protocol. "RS-232": Through a transparent serial port and based on the Telecom protocol
BaudRate		1200bps, 2400bps, 4800bps, 9600bps	9600bps	Make sure the baud rates of both the sending and receiving parties are the same
Set Date		2,000 ~ 2,099		Set the time according to the current actual time, regardless of whether it is a leap year or not
Set Time		Hour, min, sec		
Operator level or above	Init PWD (Initialize password)	Y, N	N	Selecting "Y" can reset the user level and administrator level passwords to the defaults
	Init Param (Initialize parameters)	Y, N	N	When the system parameters cannot be set normally, and the usual resetting methods do not work, you can set the "Init Param" to Y, and all the system parameters will be restored to defaults. Alarms may be raised for the defaults may fail to meet the actual situation. Set the parameters according to the actual situation then.
	System Type	48V/50A/300/NONE	This parameter has been set according to the actual situation upon delivery and needs not to be changed. However, when a new monitoring module is used, its "System Type" should be set according to the actual situation. After this parameter is changed, the monitoring module will restart automatically, and other parameters of the monitoring module will be changed to the defaults of the corresponding system type. You should change some parameters according to the actual situation.	
Administrator	Change Password	User, Operator, Admin	The password can be 6 digits long at most. If it is shorte than 6 digits, end it with a "#"	
	Con Alarm Voice	3min, 10min, 1h, 4h, constant	Contstant	The period that an alarm sound will last
	Serial	The production serial No. of the monitoring module. This parameter cannot be changed		
	SW Ver	The software version No. of the monitoring module. This parameter cannot be changed		
	Set Enable	Reflecting the jumper status of a hardware switch within the monitoring module. If this parameter is set to "N", you are not allowed to use the jumper, nor change any parameter except the battery management mode. The maintenance over the monitoring module will not be affected		

5. The model description is shown below:

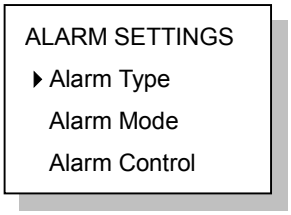


Note

Monitoring module M500D can monitor multiple power systems made by Emerson. If the system type is not set correctly, unpredictable faults may occur.

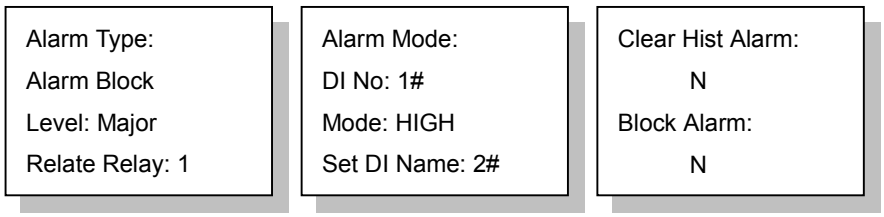
4.7.11 Alarm Settings

1. The first page of the setting interface is show below:



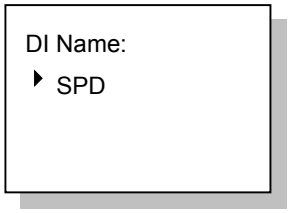
There are 3 submenus. Use "▼" or "▲" to select one, and use "ENT" to confirm.

2. The three submenus are shown below:



Use "▼" or "▲" to select one page or one of the parameters, and "◄" or "►" to select the parameter value. Press "ENT" to confirm and save.

3. After setting the "Set DI Name" and confirming it, the system will prompt you to name the DI:



Use "▼" or "▲" to change the number, and "◄" or "►" to move the cursor left or right. Press "ENT" to confirm.

4. The value description of the parameter is listed below:

Table 4-15 Alarm setting parameter description

Parameter	Range	Default	Value description	
Alarm Type	56 names of alarm events	Alarms of different types have different levels and different Relate Relays	Select those alarm events whose levels and relate relays should be reset	
Level	Critical, Major, Observation, None		There are different audible/visual alarm modes and callback modes for alarm events of different levels	
Relate Relay	Empty, No.1 ~ 8		"Empty": The corresponding dry contact will not output alarm information upon an alarm event "No. 1 ~ 8": There will be a dry contact in the range of No.1 ~ 8 that outputs the alarm information upon an alarm event	
DI No.	No. 1 ~ 8	1	The 8 corresponding connecting terminals, queued up in the order that the hardware switches are put	Effective only to self-defined DI alarms
Alarm Mode	High, Low	Low	"High": alarm upon high level; "Low": alarm upon low level. Set according to the actual situation	
Set DI Name	1# ~ 8#	1#	Serial No. of the connecting terminal for DI input	
DI Name	Figures or letters, 10 at most	SPD	When there are DI alarms, this parameter shows the alarm name you have actually defined. In the system with an AC sampling board, you can define by yourself the DIs of routes No.7 and No.8. In the system without an AC sampling board, you can define all DIs	
Clear His Alarm	Y, N	N	"Y": Delete historical alarms	
Block Alarm	Y, N	N	"Y": The active alarms will not be sent to the host (valid in EEM protocol)	

Note:

If the system is not equipped with SPD, the above item does not need to be set.

Chapter 5 Alarm Handling

5.1 General

This chapter describes the handling of alarms, as well as the preventive maintenance of the system during system daily operation.

The maintenance personnel must have adequate knowledge about the power system.

Note

1. The maintenance must be conducted under the guidance of related safety regulations.
2. Only the trained personnel with adequate knowledge about the power system can maintain the inner part of the cabinet.

5.1.1 Authorization

Adequately trained users

Only users that have been adequately trained shall overhaul the system, including testing, fault enquiry, replacing functional units, etc.

Ordinary users

Ordinary users can operate the equipment during system normal operation. They can also take necessary measures against alarms (as described in the maintenance manual) and on other occasions where there is no need to operate within the cabinet.

5.2 Handling Monitoring Module Alarms

When the monitoring module raises alarms, browse the alarm information to check the alarm type, or whether there are external interferences such as lightning storm or mains failure, etc. Meanwhile, check the date, time, voltage and load of the power system.

Note

1. Read through this chapter before the maintenance.
2. The related follow-up work must be finished after an alarm is cleared.

5.2.1 Alarm Categories

Based on the alarm's influence over the system and its level of urgency, there are four levels of alarms: Critical, major, observation and no alarm.

Critical/major alarm: Indicating a fault that seriously affects system operation. When such alarms are triggered, the system alarm indicator will turn on, generating alarm sound. Such alarms require immediate handling.

Observation alarm: Indicating a fault that under whose influence, system can sustain normal DC output for the time being. Such alarms also require immediate handling, unless it is in the non-working hours. When such alarm occurs, the system alarm indicator turns on without any sound.

No alarm: No alarms are alarms that have been invalidated by the user. Upon such alarms, system will operate normally, generating no audible/visual alarm.

5.2.2 AC Failure (Major Alarm)

When the AC power fails, the battery will power the load.

AC power failure is most common. If the failure does not last long, the battery will power the load. If the cause is unknown or the failure lasts too long, a diesel generator is needed. Before using the generator's power, it is suggested to run the generator 5 minutes to stabilize the power output.

5.2.3 AC Over-voltage (Critical Alarm)

This alarm is raised when the AC input voltage is higher than the parameter "Over Volt" (in "AC Settings"), whose default value is listed below:

Parameter	Default	Remark
AC input over-voltage alarm point	280Vac	Configurable through monitoring module

A mild over-voltage does not affect the system operation. However, the rectifier will stop operation when the mains voltage is more than 295V. Therefore, if the power supply is constantly over-voltage, the mains power network should be improved.

5.2.4 AC Under-voltage (Critical Alarm)

This alarm is raised when the system AC input voltage is lower than the parameter "LowVolt". You can check the value of "LowVolt" and modify it if it is set too high. See the following table for the defaults:

Parameter	Range	Remark
Low Volt	170Vac	Configurable through the monitoring module

When the mains voltage is lower than 176V, the rectifiers will output only half power; and when lower than 80V, 0 power. Therefore, if the power supply is constantly under-voltage, the main power network should be improved.

5.2.5 SPD Fault (Critical Alarm)

Check the SPD. If the SPD has been damaged, replace it.

5.2.6 DC Over-voltage (Critical Alarm)

This alarm is raised when the system DC output voltage is higher than the parameter "Over". Emergency handling is required.

1. Check the system DC output voltage and value of "Over" set through the monitoring module. If the set value is improper, correct it.

2. Find out the rectifier that has caused the alarm.

First of all, ensure that the batteries can operate normally. Then switch off the AC input of all rectifiers. Power on the rectifiers one by one. If the over-voltage protection is triggered when a certain rectifier is powered on, that rectifier is the faulty one. Power on other rectifiers, and the system will operate normally.

5.2.7 DC Under-voltage (Critical Alarm)

This alarm is raised when the system DC output voltage is lower than the parameter "Under". Generally this alarm is raised due to the battery over-discharge upon mains failure.

1. If the alarm is caused by mains failure, you can contact the personnel in charge of the load to see if certain loads can be disconnected to prolong the operation of the whole system.

2. If the alarm is not caused by mains failure, a possible cause is that the battery has powered the load because of rectifier failure or the load being too big for the rectifiers.

3. If the alarm is due to rectifier fault, find out the faulty rectifier and take corresponding measures.

4. If all rectifiers are operating with full load, the cause of the alarm could be that the rectifier capacity cannot meet the load's need, which leads to the discharge of the battery.

Compare the total load current with the rectifier current, and the former should not be bigger than the later at FC voltage, otherwise partial loads must be disconnected to ensure the safe operation of the whole system. Add several rectifiers to make the total rectifier current bigger than 120% of the total load current. In addition, there must be at least 1 rectifier for redundancy standby.

5.2.8 Load/Battery N Failure (Critical Alarm)

This alarm is raised when the MCB of route No.N is open/blown at the power distribution unit.

This fault is generally caused by overload, short circuit, manual disconnection or the alarm circuit being faulty.

1. If the route is connected to a MCB, check it. If the MCB is open, it is a disconnection fault. Find out the fault, remove it, and reset the MCB.

2. Otherwise, check the voltage at the alarm MCB. If the voltage is almost 0V, the alarm loop is faulty. Find out the cause.

Note

Only an adequately trained personnel who has sufficient knowledge about the power system can carry out operations over cabinet's internal parts or a functional unit.

5.2.9 Battery Protection (Critical Alarm)

This alarm is raised when the battery protection MCB is open and the battery is not connected to the power system.

1. The battery protection MCB will be open automatically when the battery voltage is lower than the "BLVD" value, or the battery discharge time is more than the "BLVD Time". The MCB will be reconnected automatically when mains recovers.

2. The battery is disconnected from the system manually.

5.2.10 Rect N Failure (Critical Alarm)

This alarm is raised when the output voltage of rectifier N is higher than the pre-set value, and therefore the rectifier is shutdown automatically.

The red LED on the rectifier will turn on.

1. Reset the rectifier by powering it off and then on again.

2. If the rectifier still causes this alarm, replace it.

5.2.11 Rect N Protect (Observation)

This alarm is raised when the rectifier stops operation due to the rectifier AC input voltage being outside the range of 80V ~ 295V (between the AC under-voltage point and over-voltage point). Therefore, if the power supply is constantly over/under-voltage, the mains power network should be improved.

5.2.12 Rect Fan Fails (Major Alarm)

This alarm is raised when the rectifier fan fails.

1. Check whether the rectifier fan is still working.

2. If the fan stands still, pull out the rectifier to check whether the fan is blocked or not. If yes, clean it and push the rectifier back. However, if the fan still does not move after the rectifier is powered on, replace it.

3. If the fan still does not work after all the above measures, replace the rectifier.

5.2.13 Rect Com Failure (Major Alarm)

This alarm is raised when the communication between rectifier and monitoring module fails, or when the rectifier fails.

1. If the alarm rectifier is normal, check the communication connection between the rectifier and monitoring module.

2. Reset the rectifier by pulling it out and pushing back in.

3. If the alarm persists, replace the rectifier.

5.2.14 Battery Manual Mode (No Alarm)

This alarm is raised when the battery management mode is switched to manual. The automatic functions disabled include: Battery BC/FC control, current limiting control, temperature compensation control, BLVD and LLVD.

1. Check why the battery management mode is set to manual.
2. If no specific reason is found, set the management mode to auto.

5.2.15 Batt Temp High (Observation)

This alarm is raised when the battery chamber temperature is higher than the set value of parameter “Over Temp”. Possible causes include: 1, Battery over-heat due to battery internal fault. 2. Battery voltage too high. 3. Battery room temperature too high.

High temperature is harmful to the battery, for it can cause leakage of the corrosive and explosive gas, battery explosion or capacity loss.

Find out the cause and remove it.

5.3 Handling Rectifier Fault

5.3.1 Handling Indicator Fault

The symptoms of usual rectifier faults include: Run indicator (green) off, Protection indicator (yellow) on, Protection indicator blink, Fault indicator (red) on and Fault indicator blink.

Table 5-1 Indicator fault description

Symptom	Cause	Suggestion
Run indicator off	No input/output voltage	Make sure there is input/output voltage
Protection indicator on	AC input voltage abnormal	Make sure the AC input voltage is normal
	PFC internal under/over voltage	Replace the rectifier
	Serious current sharing imbalance	Replace the rectifier
	Over-temperature protection is triggered due to:	1. Remove the object that blocks the fan 2. Remove the object at the inlet or vent 3. Decrease the ambient temperature or remove the heat source
	1. Fan blocked	
	2. Ventilation path blocked at the inlet or vent	
	3. Ambient temperature too high or the inlet too close to a heat source	
Protection indicator blinks	Rectifier communication interrupted	Check whether the communication cable is in normal connection
Fault indictor on	Rectifier over-voltage	Reset the rectifier. If the protection is triggered again, replace the rectifier.
	Output MCB blown	Check whether it is due to output over-voltage. If not, replace the rectifier
Fault indicator on	Fan does not work	Replace the fan

5.3.2 Handling Current Sharing Imbalance

This fault refers to the case when the current difference among parallel rectifiers is bigger than ±1.5A.

Check whether the rectifier communication is normal. If not, check whether the communication cable is in normal connection.

If the communication is normal while the current sharing is unbalanced, replace the rectifier that does not share the current.

5.3.3 Replacing Rectifier Fan

If the rectifier fan is faulty and does not work, it should be replaced. See the following procedures:

1. Use a cross screwdriver to remove the 3 screws from the fixing holes and pull out the front panel
2. Unplug the fan and remove it
3. Install a new fan
4. Plug the fan power cable
5. Put the front panel back and fasten it with the 3 screws

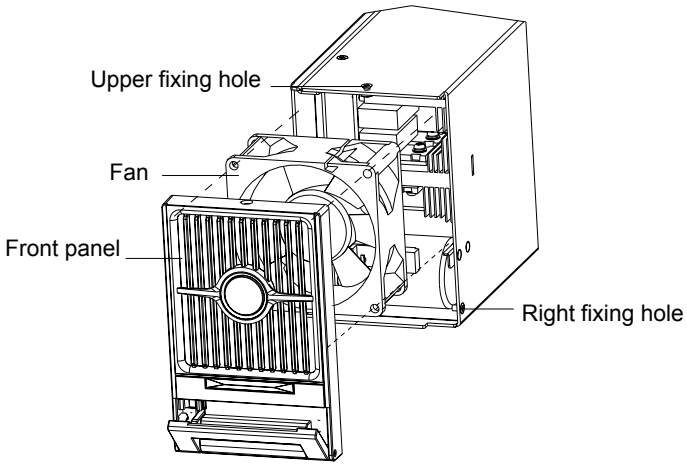


Figure 5-1 Disassembling the front panel

5.3.4 Replacing Rectifier

If no indicator on the rectifier is on, check whether there is input/output voltage. If no, switch off the AC input, eliminate the fault with input/output and switch on again.

If the rectifier has no output from time to time, use an oscilloscope or a power network analyzer to check the input AC voltage. If short-term over-voltage or peaks exist, switch off the AC input, eliminate the problem with the power network before switching on the AC input again.

Except replacing the fan, it is recommended not to repair any other part of the module. When faulty, the module should be replaced, not repaired. See the following procedures to replace the rectifier.

1. Take a new rectifier and check it for any damage from transport.

2. Pull out the faulty rectifier from the rack by grabbing its handle.

Be careful with the rectifier just pulled out from the system, as it could be very hot due to long-term operation. Do not let it slip away and get damaged.

3. By holding the rectifier handle, push the new rectifier into the slot just vacated and make sure the connection is good.

After a brief delay, the rectifier RUN indicator will turn on and the fan will start running.

4. Check whether the new rectifier works normally.

You should make sure that:

1) The monitoring module recognizes the new rectifier

2) The new rectifier shares current with other rectifiers

3) When this new rectifier is pulled out, there is a corresponding alarm and the monitoring module displays the alarm.

If the new rectifier passes all the above tests, the replacement is a success.

5. Push the handle back into the front panel to fix the rectifier with the positioning pin.

5.4 Final Steps

After the alarms are cleared, do the following before you leave:

1. Ensure all the alarms of the power system have been handled and there are no active alarms any more.
2. Ensure that all the functional units of the system operate normally.
3. Disconnect all the testing equipment from the power system. Remove every object that does not belong to the power system.
4. If dry contact output alarm device has been installed, ensure that the alarm circuit is closed.
5. Restore the power equipment to its original state and close the cabinet door.
6. Note down all the operations conducted on the power system, including operation time and operator name.
7. If the fault cannot be removed, contact the professional maintenance personnel who have been trained for this system.
8. If the faulty unit needs repairing, write a fault report, which should be handed over together with the faulty unit to the related personnel.

Appendix 1 Technical Specifications

Parameter category	Parameter	ACTURA OPTIMA 48200 (PS48165/3200)
Environmental	Operating temperature	-5°C ~ 40°C
	Storage temperature	-40°C ~ 70°C
	Relative humidity	5%RH ~ 95%RH (40 ± 2°C)
	Altitude	⩽2,000m (derating is necessary above 2,000m)
	Others	No conductive dust or erosive gases. No danger of explosion
AC input	AC input system	3-phase 5-wire system or 1-phase 3-wire system
	Rated input phase voltage	220Vac/ 380Vac
	Input voltage range	85Vac ~ 290Vac
	Input AC voltage frequency	45Hz ~ 65Hz
	Max input current	⩽ 60A (at 170V input, single phase input) ⩽ 20A (at 170V input, three phase input)
	Power factor	⩾ 0.99
DC output	Rated output DC voltage	-48Vdc
	Output DC voltage	-42.4Vdc ~ -57.6Vdc
	Output DC current	0A ~ 200A
	Voltage set-point accuracy	⩽ ±1%
	Efficiency	⩾ 90%
	Noise (peak-peak)	⩽ 200mV
	Weighted noise	⩽ 2mV
	Wide frequency noise	⩽ 100mV (3.4kHz ~ 150kHz) ⩽ 30mV (150 kHz ~ 30MHz)
	Discrete noise	⩽ 5mV (3.4 kHz ~ 150kHz) ⩽ 3mV (150 kHz ~ 200kHz) ⩽ 2mV (200 kHz ~ 500kHz) ⩽ 1mV (0.5 MHz ~ 30MHz)
AC input alarm and protection	AC input over-voltage alarm point	Default: 280 ± 5Vac, cofigurable through monitoring module
	AC input over-voltage recovery point	Default: 270 ± 5Vac, 10Vac lower than the AC input over-voltage alarm point
	AC input under-voltage alarm point	Default: 180 ± 5Vac, configurable through monitoring module
	AC input under-voltage recovery point	Default: 190 ± 5Vac, 10Vac higher than the AC input under-voltage alarm point
DC output alarm and protection	DC output over-voltage protection point	Default: 59.0 ± 0.2Vdc
	DC output over-voltage alarm point	Default: 58.5 ± 0.2Vdc, configurable through monitoring module
	DC output over-voltage recovery point	Default: 58 ± 0.2Vdc, 0.5Vdc lower than the over-voltage alarm point
	DC output under-voltage alarm point	Default: 45.0 ± 0.2Vdc, configurable through monitoring module
	DC output under-voltage recovery point	Default: 45.5 ± 0.2Vdc, 0.5Vdc higher than the under-voltage alarm point
	LLVD	Default: 44 ± 0.2Vdc, configurable through monitoring module
	BLVD	Default: 43.2 ± 0.2Vdc, configurable through monitoring module
Rectifier	Current sharing	The rectifiers can work in parallel and share the current. The unbalanceness is better than ± 5% rated output current.. Test current range: 10% ~ 100% rated current.
	Derate by input	The rectifier can output max. power of 3200W with input voltage of 176Vac ~ 290Vac.; With input voltage between 85V and 176V, there will be a linear derating. Rectifiers output 50% power with input voltage of 120Vac, or 18.75% power with input voltage of 85Vac

Parameter category	Parameter	ACTURA OPTIMA 48200 (PS48165/3200)
Rectifier	Over-voltage protection	The rectifier provides over-voltage hardware and software protection. The hardware protection point is between 59.5V and 60V, and it requires manual resetting to restore operation. The software protection point is between 56V and 59V, and can be set through the monitoring module. There are two software protection modes, which can be selected through the software at the host: 1. Lock out at the first over-voltage Once the output voltage reaches protection point, the rectifier will shut off and hold that state. it requires manual resetting to restore the operation. 2. Lock out at the second over-voltage When the output voltage reaches the software protection point and the current is bigger than 5A, the rectifier will shutdown, and restart automatically after 5 seconds. If the over-voltage happens again within a set time (default: 5min. Configurable through monitoring module), the rectifier will shut off and hold that state. It requires manual resetting to restore the operation. If the rectifier output current is smaller than 5A, the rectifier will not shut down, no matter whether the software protection point is reached or not. Manual resetting: Resetting can be done manually through the monitoring module, or by removing the rectifier from system
	Output delay	Output voltage can rise slowly upon rectifier start up. The rise time is configurable
	Fan speed adjustable	Rectifier fan speed can be set to half or full speed.
	Temperature derating	At the ambient temperature of: Below 45°C, outputs full power: 3,200W Above 45°C, there will be linear derating, that is: At 55°C, output power ⩾ 80% At 60°C, output power ⩾ 50% At 65°C, output power: 0W
EMC	CS	Class A EN55022,
	RS	
	Immunity to EFT	Level 3 EN61000-4-4
	Immunity to ESD	Level 3 EN61000-4-2
	Immunity to Surges	Level 4 EN61000-4-5
Lightning protection features	At AC side	The AC input side can withstand five times of simulated lightning voltage of 5kV at 10/700μs, for the positive and negative polarities respectively. It can withstand five times of simulated lightning surge current of 20kA at 8/20μs, for the positive and negative polarities respectively. The test interval is not smaller than 1 minute. It can also withstand one event of simulated lightning surge current of 40kA at 8/20μs.
	At DC side	The DC side can withstand one event of simulated lightning current of 10kA at 8/20μs.
Others	Acoustic noise	⩽ 60dB (A)
	Insulation resistance	At temperature of 15°C ~ 35°C and relative humidity not bigger than 90%RH, apply a test voltage of 500Vdc. The insulation resistances between AC circuit and earth, DC circuit and earth, and AC and DC circuits are all not less than 10MΩ.
	Insulation strength	(Remove the SPD, monitoring module and rectifiers from the system before the test.) AC to DC circuits, AC circuit to earth: 50Hz, 2,500Vac (RMS). DC circuit to earth: 50Hz, 1,000Vac (RMS). Assistant circuit (not directly connected to the host circuit): 50Hz, 500Vac (RMS). For all the three tests above, there should be no breakdown or flashover within 1min, with leakage current not bigger than 10mA.
	MTBF	250,000hr
Mechanical	Size (mm)	Powe supply system: 600(W) × 600(D) × 1600(H) Battery rack: 600(W) × 600(D) × 1600(H)
	Weight	<75kg (excluding modules and batteries)

Appendix 2 Specs Of AC Connection Devices

Table 2 Specs of AC connection devices

AC distribution mode	MCB type	Connection type
1P+N/220V+SPD	3×32A/1P	2×UIK35
1P+N/220V	3×32A/1P	2×UIK35
3P+N+PE/380V+SPD	3×32A/1P	4×UIK35
3P+N+PE/380V	3×32A/1P	4×UIK35
3P+N+PE/380V+SPD (without rectifier MCBs)	0	4×UIK35
3P+N+PE/380V(without rectifier MCBs)	0	4×UIK35
3P+PE/220V+SPD	3×63A/1P	3×UIK35
3P+PE/220V	3×63A/1P	0
L1+L2/220V+SPD	2×80A/1P	2×UIK35
L1+L2/220V	2×80A/1P	0

Appendix 3 System Schematic Diagram

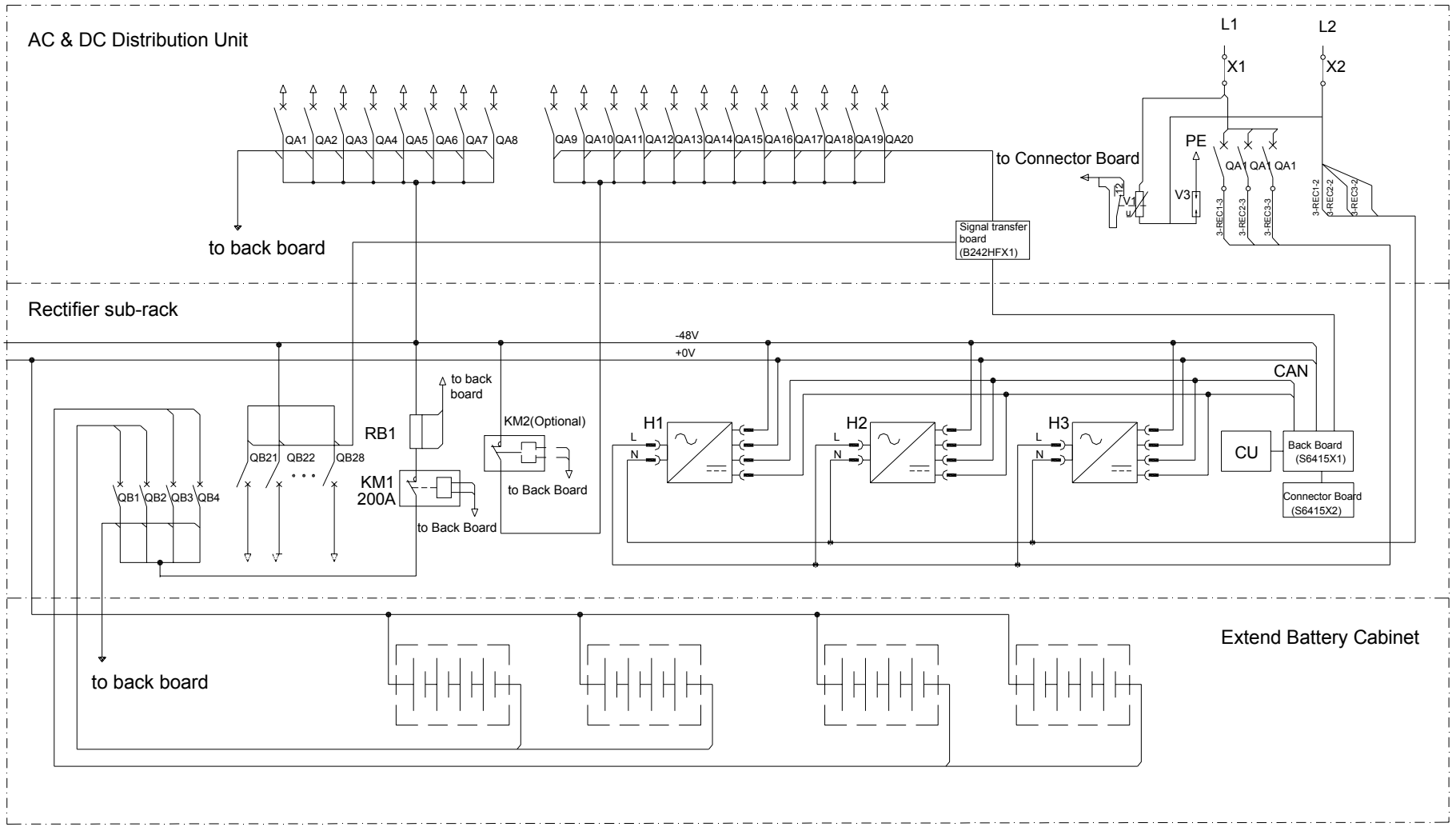


Figure 1 ACTURA OPTIMA 48200 (PS48165/3200) system schematic diagram

Appendix 4 System Wiring Diagram

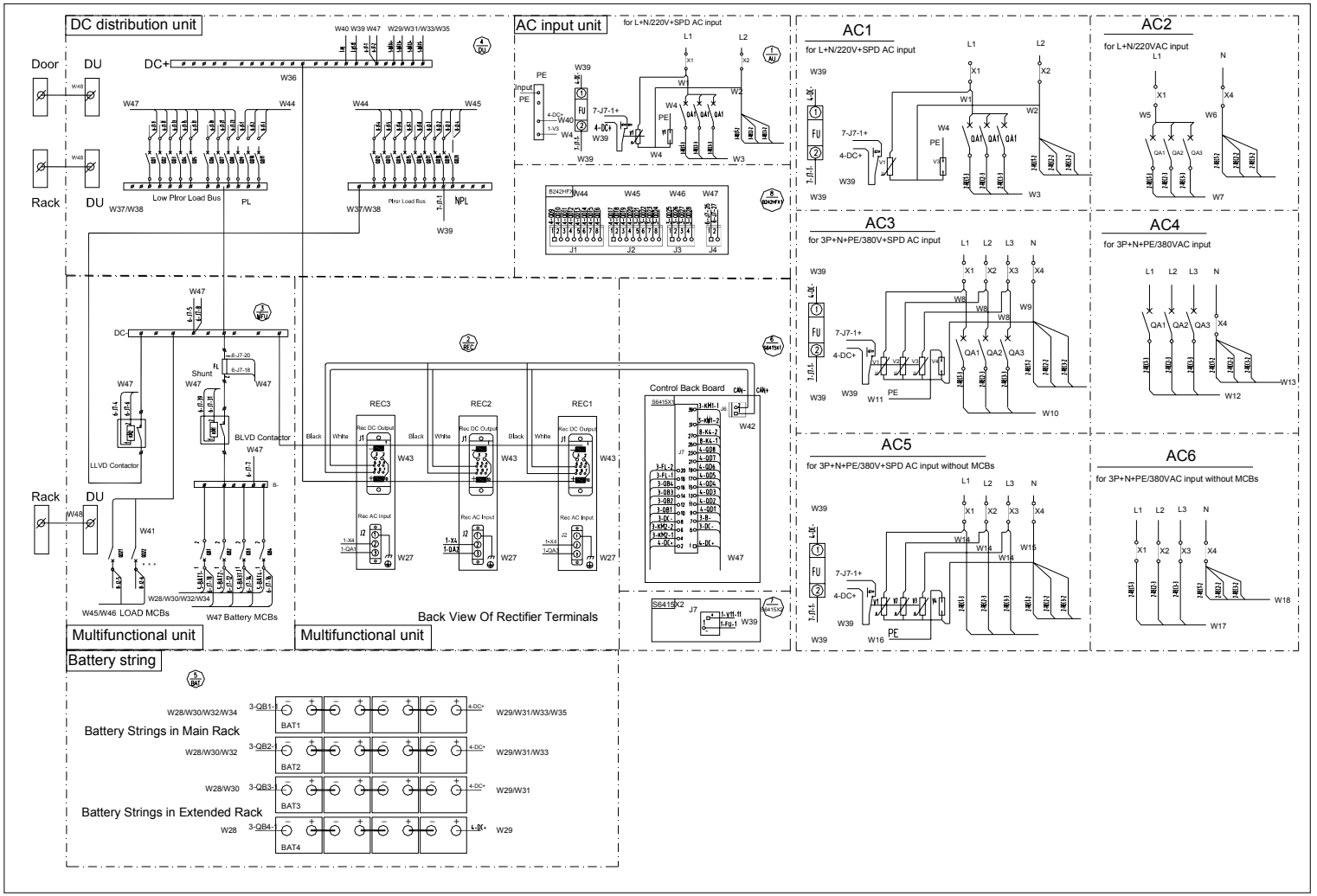


Figure 2 ACTURA OPTIMA 48200 (PS48165/3200) system wiring diagram

Appendix 5 Glossary

Abbreviation	Full word
Amb.Temp	Ambient Temperature
Batt	Battery
BC	Boost Charging
BLVD	Battery Lower Voltage Disconnection
Cap	Capacity
CommMode	Communication Mode
CurrLimit	Current Limit
CycBC	Cyclic Boost Charging
Con Alarm Voice	Control Alarm Voice
Hist Alarm	Historical alarm
HVSD	High Voltage Shutdown
InitParam	Initialize Parameters
InitPWD	Initialize Password
LLVD	Load Low Voltage Disconnection
LVD	Low Voltage Disconnection
MCB	Miniature Circuit Breaker
Ph-A	Phase A
PWD	Password
Rect	Rectifier
Shunt coeff	Shunt Coefficient
SPD	Surge Protection Device
SW Version	Software Version
Sys	System
Temp	Temperature
Temp Comp	Temperature Compensation
Volt	Voltage